

1150-1153-LT10 BUTTERFLY VALVES WITH ACTREG PNEUMATIC ACTUATOR

FEATURES

1150-1153-LT10 butterfly valves are intended for the automatic opening /closing of very diverse fluid pipes. The valve body is made of GS cast iron. The different configurations of the butterfly materials and of the liner make it suitable for many applications. Wafer mounting with centring ears between PN10/16 and ANSI 150 flanges. The ISO 5211 mounting pad allows the actuator to be directly assembled. The AP RE (adjustable stops) pneumatic motorisation is available in double and spring-return with numerous options.



LIMITS OF USE

Fluid pressure : PS	10 bar
Test pressure : PT	30 bar
Fluid temperature : TS	According to the table below
Ambiente temperature	-15°C / +100°C
Motor compressed air	Mini 6 bar / maxi 10 bar

AVAILABLE MODELS

DN 32-40 to DN 400.

Connection between flanges PN10/16 and ANSI 150 RF.

Double (ADA) and spring return (ASR) actuator .



Ref.	Butterfly	Liner	Example of applications	WT° min	WT° max
1150	316 SS / GS cast iron	EPDM	Cold water – warm water (110°C at peak) - ACS	-10°C	+110°C
1153	316 SS	EPDM	Demineralised water – alkalis (110°C at peak) - ACS	-10°C	+110°C

DIRECTIVES AND MANUFACTURING STANDARDS

OBJET	Standard	ON	OBJET	Standard
Pressure Equipment Directive 2014/68/EC	Cat. III modules B+C1	0409	Final test	ISO 5208
ATEX Directive	II 2G/D Tx zones 1,2,21 and 22	0038	Face-to-face dimension	ISO 5752 series 20
Flange dimension	EN 1092-1		Actuator pilot connection	NAMUR
Connection Motorisation	ISO 5211:		Switch box connection	VDI/VDE 3845
Sanitary conformity	ACS No. 07 ACC LY 504		Pneumatic actuator	EN 12517-3
SIL 3 level (Valve)	IEC 61508	TÜV	SIL 3 level (the actuator alone)	NKS 61508

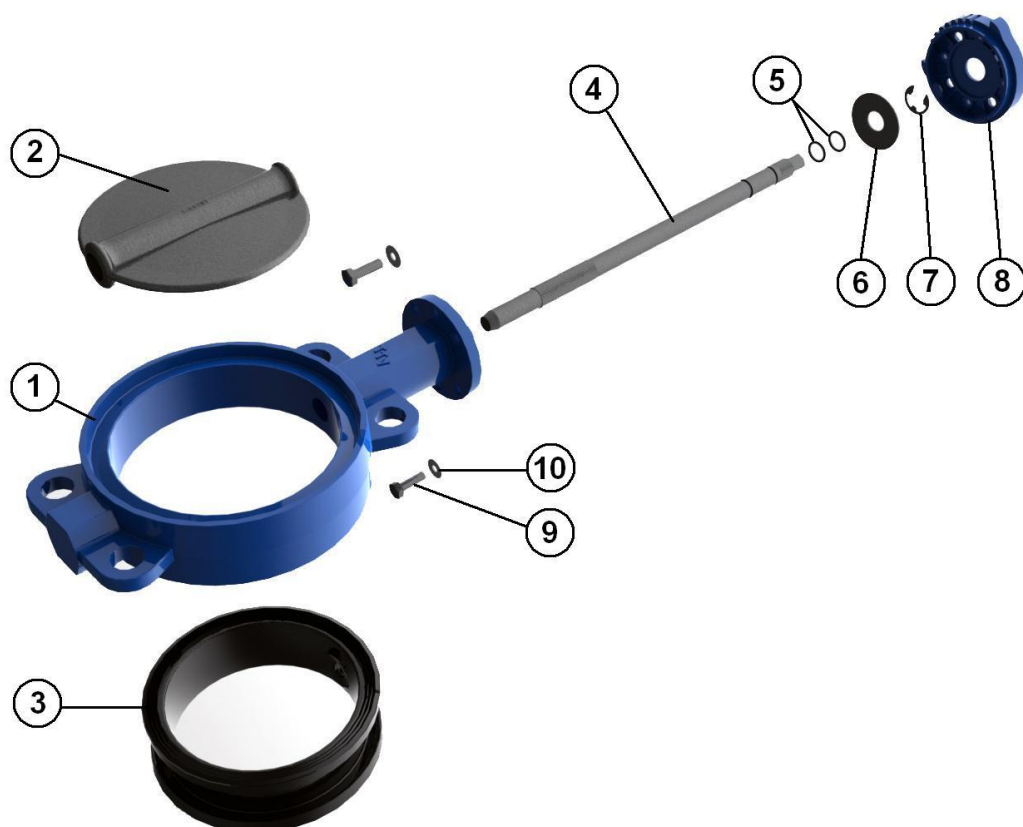
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CONSTRUCTION

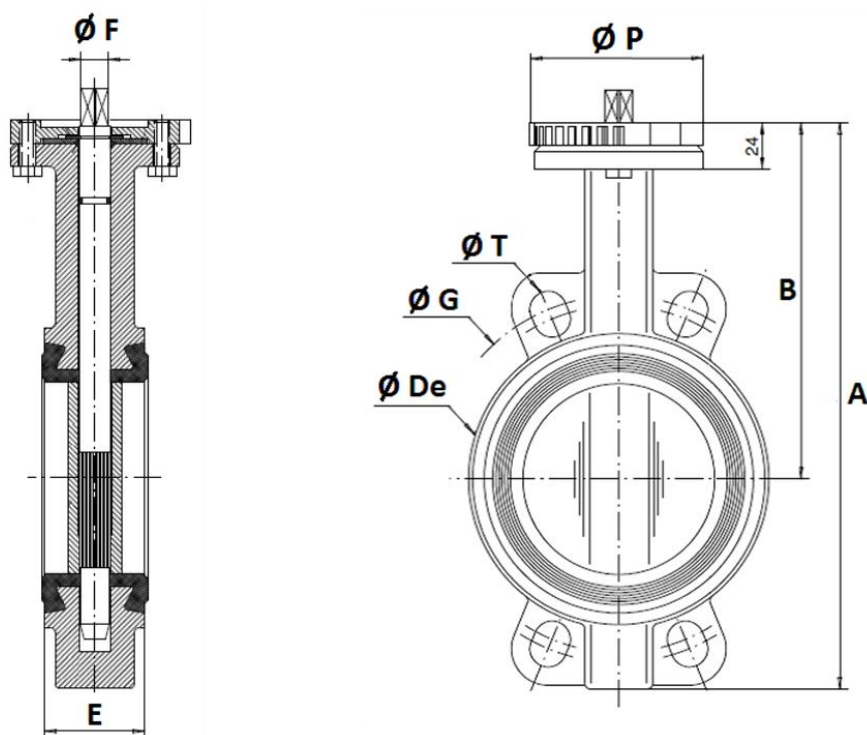


No°	Name	1150	1153
1	Body	GS EN GJS-500-7 cast iron	
2	Butterfly DN32-100	1.4408 SS	
3	Butterfly DN125-400	GS EN GJS-500-7 cast iron	1.4408 SS
3	Liner	EPDM	EPDM
4	Stem	420 SS	304 SS
5	O-ring	EPDM	EPDM
6	Ring	Steel	
7	Circlips	Steel	
8	ISO mounting pad	aluminium	
9	Screw	5.6 Steel	
10	Washer	Steel	

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DIMENSIONS (mm)



DN	32-40	50	65	80	100	125	150	200	250	300
A	206	228	248	265	298	331	349	430	461	524
B	140	156	161	169	187	206	215	255	248	280
Ø De	82	102	119	135	155	185	208	270	328	381
E	33	43	46	46	52	56	56	60	68	78
Ø F	9.5	9.5	12.5	14	14	17	17	21	23	26.5
Ø G	110	125	145	160	180	210	240	295	350	400
Ø P	88	88	88	88	88	105	105	105	150	150
Ø T	18	18	18	18	18	18	23	23	23	23
Weight (kg)	2,46	3,66	4,40	4,60	6	7,60	9,20	14,7	24,7	33

DN	32-40	50	65	80	100	125	150	200	250	300
Kv	70	109	200	334	551	901	1427	2383	3825	5659

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1150-1153-LT10 BUTTERFLY VALVES WITH ACTREG PNEUMATIC ACTUATOR

ACTREG PNEUMATIC MOTORISATION

The ALPHAIR RE motorisation proposed as standard comprises:

- rack and pinion actuator of anodised aluminium.
- a safety coefficient of 1.3 minimum compared to the nominal torque of the valve.
- air non-lubricated dry motor, minimum 6 bar pressure.
- an upstream / downstream pressure difference $\Delta P=10$ bar max.

The actuator assembly is of the following types:

- direct assembly with DN 32 to DN 200 aluminium motorisation mounting pad.
- yoke + stainless steel drive according to the EN 15081 standard for DN 250 to DN 400.

DN	Double-effect	V (litres)	Time (s)*	Spring-return	V (liters)	Time (s)*
32-40	ADA 20	0,13	0,1	ASR 40	0,27	0,2
50	ADA 20	0,13	0,1	ASR 40	0,27	0,2
65	ADA 40	0,27	0,1	ASR 80	0,64	0,3
80	ADA 40	0,27	0,1	ASR 80	0,64	0,3
100	ADA 80	0,64	0,3	ASR 130	0,77	0,5
125	ADA 80	0,64	0,3	ASR 200	1,20	0,6
150	ADA 130	0,77	0,5	ASR 300	1,96	0,9
200	ADA 200	1,20	0,6	ASR 500	2,95	1,1
250	ADA 300	1,96	0,9	ASR 500	2,95	1,1
300	ADA 500	2,95	1,1	ASR 850	4,70	2,6

For any other operating conditions, please contact us.

*indicative time of the no-load actuator for opening or closing..

INSTALLATION IN AN ATEX ZONE

For 1150-LT10+ACTREG automatic valves to be installed in ATEX 1, 2, 21 or 22 zones, this has to be specified when ordering. Our services will check of the assembly, the installation of an earthing braid, and will issue an assembly certificate. Our authorised technicians carry out these operations in the workshop. Please contact us.

The special assembly and maintenance instructions for motorised valves in the ATEX zones must be followed.

OPTIONS DE MOTORISATION

1	actuators dimensioned for a compressed air pressure of 3, 4 or 5 bar
2	actuator dimensioned for an upstream / downstream pressure difference ΔP greater than 10 bar
3	actuator with special coatings, stainless steel actuator
4	Actuator for very low (-60°C) or very high (+150°C) ambient temperatures.
5	manual override with declutchable gear box
6	compressed air filter regulator
7	All types of piloting solenoid valves
8	all types of switch boxes
9	all types of positioner
10	rapid exhaust, flow-rate limiters - exhaust brakes
OPTIONS ON THE VALVE	
1	Carbon steel body, 304 and 316 SS, bronze and aluminium
2	Carbon steel butterfly, 304 and 316 SS, copper-alu, Uranus, Hastelloy
3	Hypalon liner, silicone steam, white EPDM, natural rubber, neoprene, vulcanised
4	Stems of 420, 304, 316 SS, Hastelloy

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114x, 115x AND 116x VALVES + ACTREG ACTUATOR ASSEMBLY AND MAINTAINANCE INSTRUCTIONS

1 / CAUTIONS



1.1 - Cutting or crushing hazard

Never operate an automatic butterfly valve before its full assembly on the pipe installation. The accidental operation of the butterfly could lead to crushing or cutting of the operator's hand or arm.

1.2 - Burn hazard

114x, 115x and 116x +ACTREG automatic valves can include a pilot-operated solenoid valve coil. The coil is intended to be permanently powered. In such a case, the coil could become very hot, hence you should not touch the coil to avoid a burn hazard.



2/ CHECKS AT ACCEPTANCE

2.1 - order number check

The valve code is shown on the SECTORIEL label affixed on the actuator. Check that the code is identical with that shown on the delivery slip and the acknowledgement of receipt of your order.

2.2 - valve diameter check

The valve code is also shown on the SECTORIEL label affixed on the actuator. Check that the diameter matches that of your pipe installation.

2.3 - flange standard check

114x and 115x +ACTREG valves have smooth lugs for mounting between PN10/16 flanges as per the EN 1092-1 standard and ANSI 150 as per the ANSI B16.5 standard. Check that the flanges of the pipe installation correspond to one of these standards.

The **1160-61-62-63-64** valves have internally threaded lugs. They are compatible with PN10/16 flanges up to DN150 and PN10 from DN200 to DN300 as per the EN 1092-1 standard. Check that the pipe installation is as per the standard.

2.4 - power supply voltage check

The power supply voltage of the pilot solenoid valve is shown on the coil. Check that the voltage matches that expected for the control of the automatic valve.

2.5 - compressed air supply pressure check

The supply pressure of the actuator is shown on the actuator's plate. Check that the compressed air network feeding the valve is indeed at this pressure. If need be, install a regulator filter upstream.

2.6 - fluid and ambient temperature parameter check

The pressure and temperature limits for the valve in service are shown in the table below. Check that, for your service, the pressure and temperature are compatible with the limits

SECTORIEL 38290 - FRANCE	SERIAL NUMBER	VALVE
	CODE	DN
	ACTIO	MO
	Read the mounting and servicing instructions carefully	

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1150-1153-LT10 BUTTERFLY VALVES WITH ACTREG PNEUMATIC ACTUATOR

Fluid pressure: WP	16 bar up to DN 200 10 bar up to DN 400
Fluid temperature: WT	According to the table below
Ambient temperature	-15°C / +80°C
Motor compressed air	minimum 6 bar / maximum 10 bar

3 / STORAGE INSTRUCTIONS

Follow our "IMESTOCK" instructions for storage.

4 / ASSEMBLY INSTRUCTIONS

4.1 - Place of installation

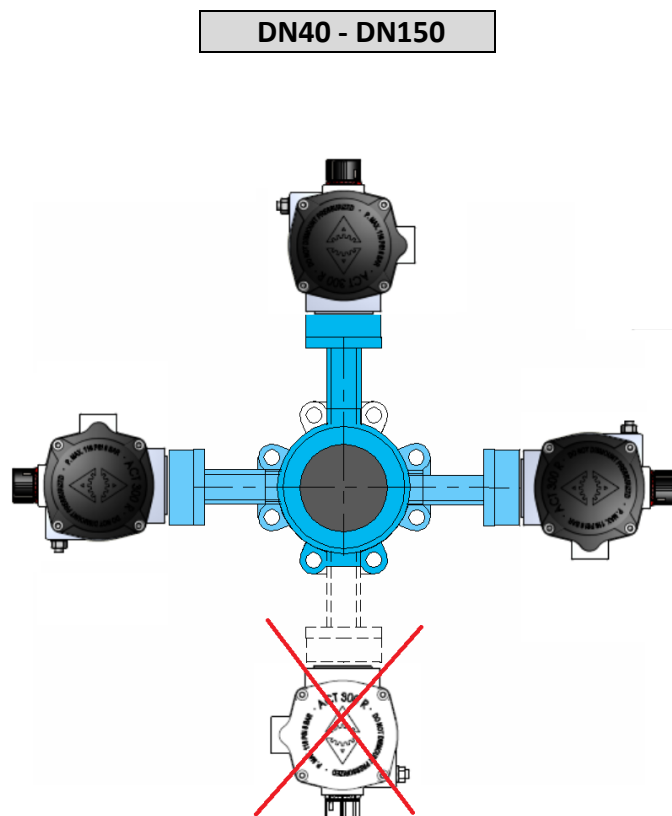
The 114x, 115x and 116x + ACTREG automatic valves can be installed both indoors and outdoors, while complying with the limit temperatures given in § 3.6.

If the valve is equipped with accessories (switch box, pilot solenoid valve), check their service temperatures and their IP code depending upon the place of installation.

4.2. - Connection to the pipe installation

4.2.1 - Mounting positions

The automatic valve has to be mounted either vertically or horizontal ly with an actuator, as shown in the diagram below:

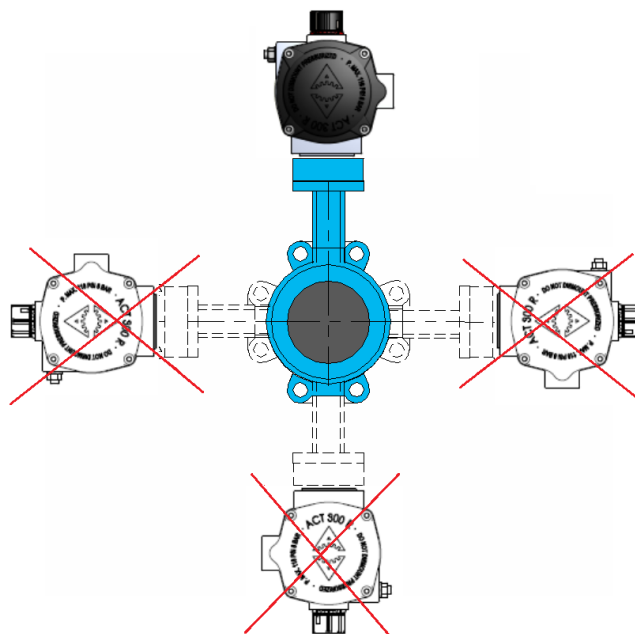


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DN200 - DN400

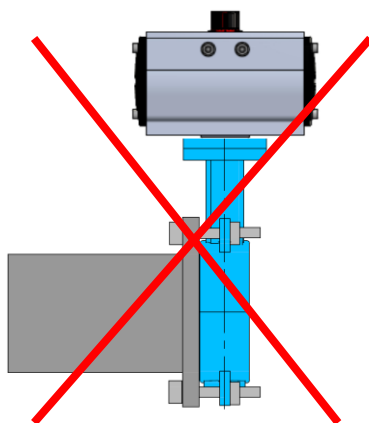
Authorised with
suitable support



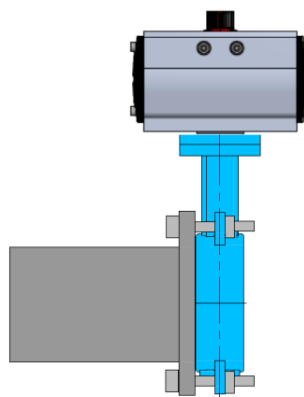
Authorised with
suitable support

4.2.2 - Mounting at the end of a line

114x and 115x butterfly valves must not be installed at the end of a line. Only the 116x valves can be installed at the end of a line.



114x-115x



116x

Possible blocking of the butterfly: protruding length.

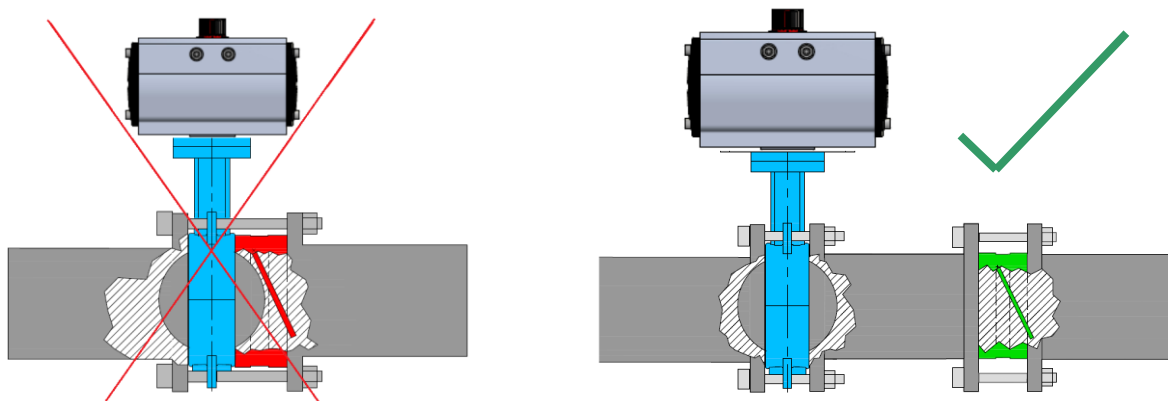
At valve opening, the butterfly protrudes from the body according to the lengths shown in the table below.

DN	40	50	65	80	100	120	150	200	250	300	350	400
Protrusion (mm)	3,5	3,5	9,5	17	24	33,5	45,5	69	90	110,5	131	148

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You must take it into account at mounting and not abut another valve element immediately upstream and downstream which could block the movement of the butterfly (e. g. a swing valve).



4.2.3 - Mounting precautions:

Before any intervention on the valve, please follow the following indications:

Before installing the valve, clean the piping (brazing residues, metal swarf, sealing material, etc.).

Isolate the pipe installation upstream and downstream.

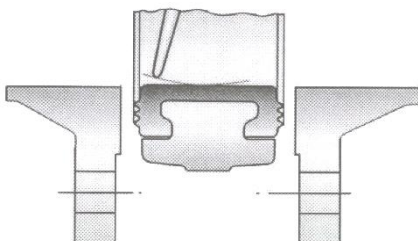
Bleed the pipe installation in order to bring it to ambient temperature and pressure.

Do not force the piping to align it so as to prevent applying stress on the valve body.

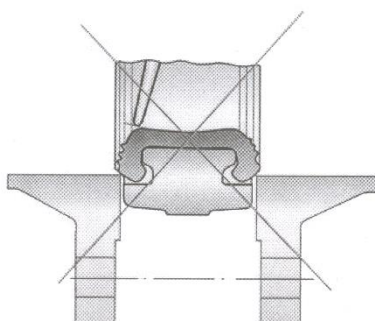
Wear the safety equipment required for this type intervention (gloves and goggles).

4.2.4 - Valve installation on the piping

For all asymmetrical devices, check their orientation with regard to the normal direction of flow, and you must mount them in their operating position.



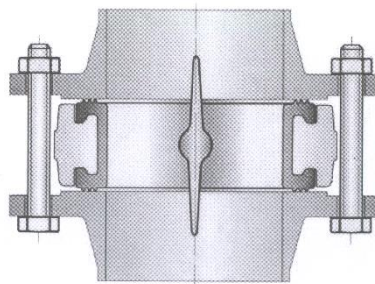
The gap in-between flanges has to be large enough to allow the valve be inserted without the elastic liner getting caught. The butterfly has to be in an almost closed position.



The liner can get damaged if the counter-flanges are not sufficiently spaced.

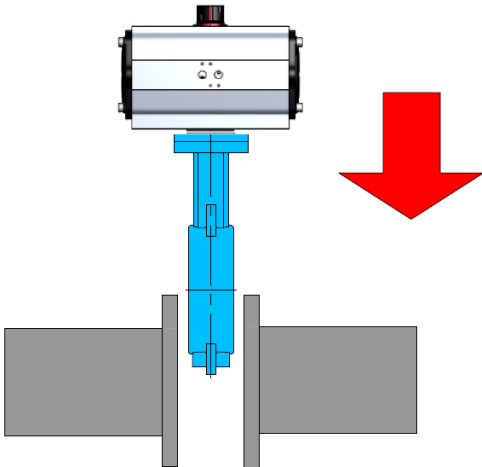
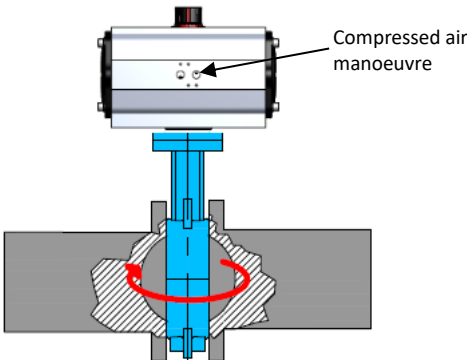
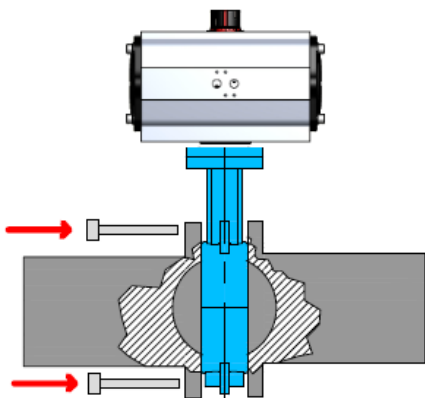
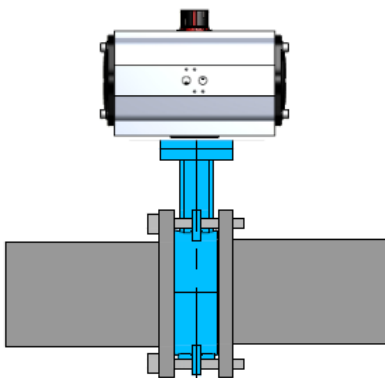
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The butterfly has to be in the fully open position after positioning the valve in-between the counter-flanges and before tightening the bolts, otherwise the elastic liner might be deformed or deteriorated during the tightening of the first manoeuvre.

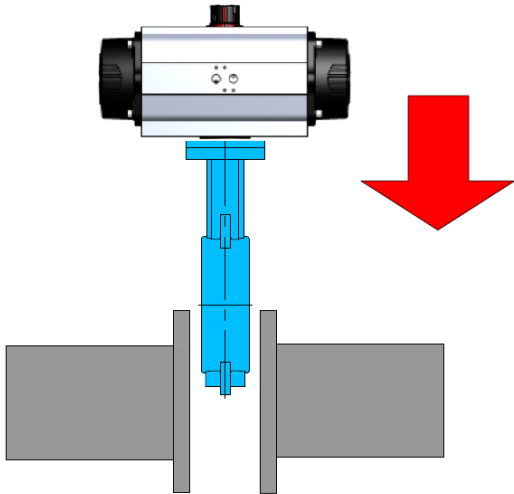
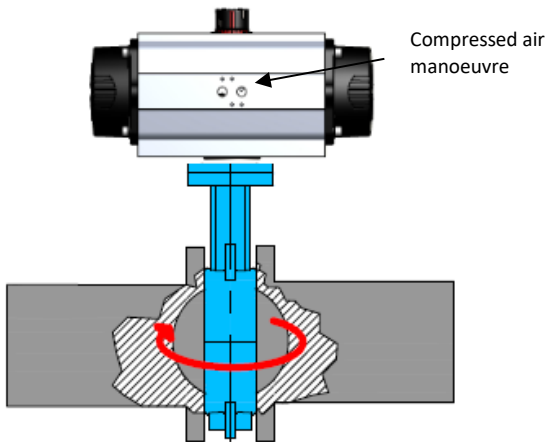
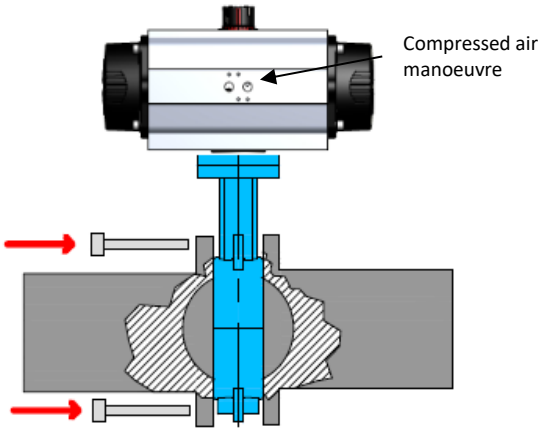
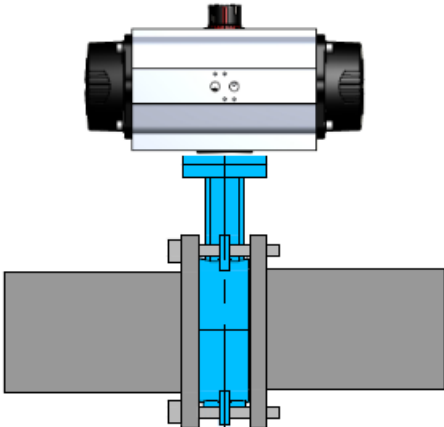
4.2.5 - Installation of the double acting ADA version

1	2
	
Lowering of the valve along the pipe installation axis	Compressed air manoeuvre for opening the valve
3	4
	
Bolting Valve open	Installed valve

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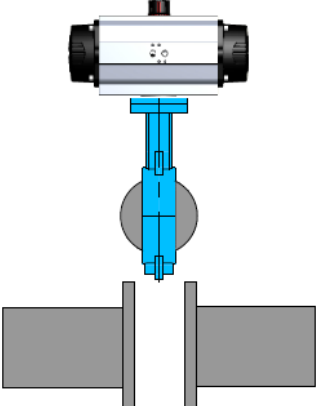
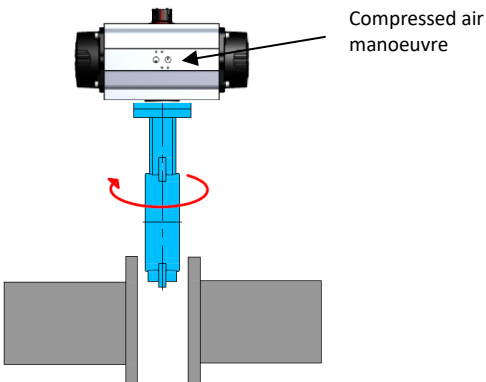
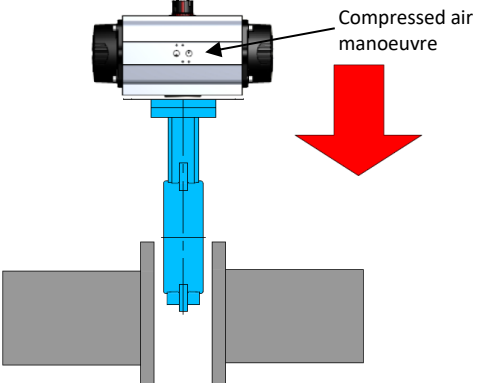
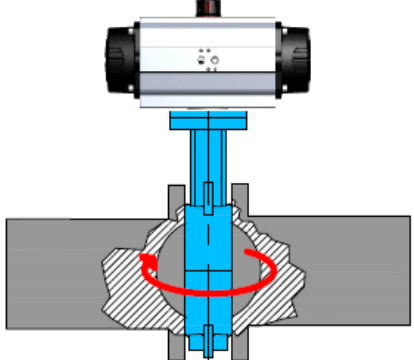
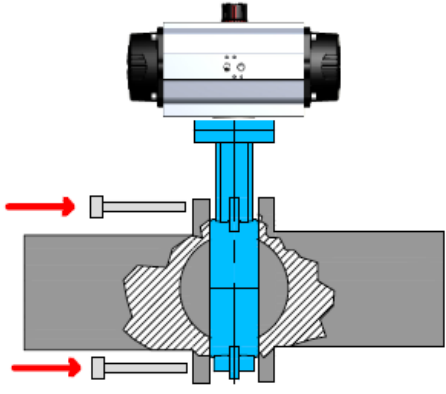
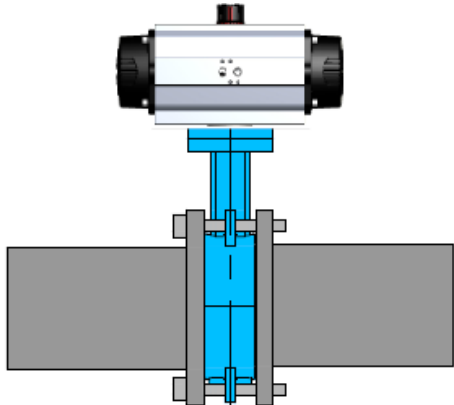
4.2.6 - Installation of the single acting NC (normally closed) ASR version

1	2
	
Lowering of the valve along the pipe installation axis.	Compressed air manoeuvre throughout the installation, for opening the valve. Indeed, if the air supply is cut-off, the valve will be closed by the return of the actuator's spring.
3	4
	
Bolting Open valve	Installed valve

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4.2.7 - Installation of single acting NO (normally open) ASR version

1 	2  Compressed air manoeuvre
Valve normally closed	Valve opening by the return of the AP's spring
3  Compressed air manoeuvre	4 
Lowering of the valve along the pipe installation axis	Valve opening by the return of the AP's spring
5 	6 
Open valve bolting	Installed valve

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4.2.8 - connection to the pipe installation

Nuts and bolts for PN10/16 114x and smooth lug 115x

DN	ØD		ØK		Hole number		Nuts and bolts	
	PN10	PN16	PN10	PN16	PN10	PN16	PN10	PN16
40	150		110		4		M16x90	
50	165		125		4		M16x100	
65	185		145		4		M16x110	
80	200		160		8		M16x110	
100	220		180		8		M16x120	
125	250		210		8		M16x130	
150	285		240		8		M20x140	
200	340		295		8	12	M20x140	
250	395	405	350	355	12	12	M20x160	M24x
300	445	460	400	410	12	12	M20x160	M24x
350	505	520	460	470	16	16	M20x170	\
400	565	580	515	525	16	16	M24x200	\

Nuts and bolts for PN10/16 116x and threaded lug 118x

DN	ØD		ØK		Hole number		Nuts and bolts	
	PN10	PN16	PN10	PN16	PN10	PN16	PN10	PN16
40	150		110		4		Zinc-plated M16x30 steel screw	
50	165		125		4		VAZ M16x35	
65	185		145		4		VAZ M16x35	
80	200		160		8		VAZ M16x40	
100	220		180		8		VAZ M16x40	
125	250		210		8		VAZ M16x45	
150	285		240		8		VAZ M20x45	
200	340		295		8	12	VAZ M20x45	
250	395	405	350	355	12	12	VAZ 20x45	VAZ 24x
300	445	460	400	410	12	12	VAZ 20x60	VAZ 24x
350	505	520	460	470	16	16	VAZ 20x	\
400	565	580	515	525	16	16	VAZ 24x	\

4.3 - connection to the compressed air supply network

The compressed air connection is performed through the port 1 – G 1/4" threaded – of the pilot solenoid valve.
Exhausts 3 and 5 - G 1/8" threaded - are factory equipped with silencer filters.

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4.4 - pilot solenoid valve connection to the electrical control network

The electrical connection shall be performed by qualified personnel, as per the standards in vigour.

Depending upon the supply voltage, the components have to be earthed as per the standards and local regulations in vigour.

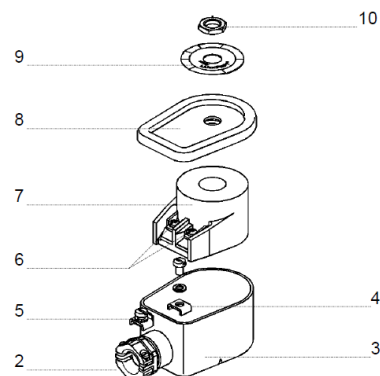
The coil must be wired with the power off.

Remove the coil of the pilot solenoid valve by unscrewing the upper nut.

Slip the cable through the cable clamp and the associated cable gland (M20x1.5)

Connect the cable wires to the coil terminals and to the earth crimp connector.

When the coil is well centred, tighten the cable gland and the cable holding jaws.



4.5 - switch box connection to the electrical control network

The electrical connection shall be performed by qualified personnel, as per the standards in vigour.

Depending on the supply voltage, the components



4.6 - operating test

Perform an operating test as follows after having made the pneumatic and electrical connections:

A / opening test

- power the coil of the pilot solenoid valve,

- visually check that the valve is open: the switch box indicator must show the OPEN position,

b / closing test

- turn off the power supply to the coil of the pilot solenoid valve,

- visually check that the valve closes instantaneously: the switch box indicator must show the CLOSED position.

5 / MAINTENANCE INSTRUCTIONS

5.1 - Before any intervention

5.1.1 - Depressurize, drain and bring to ambient temperature, the pipe installation on which the valve is mounted.

5.1.2 - Close the compressed air supply to the actuator and depressurize the actuator. The valve will then close automatically.

5.1.3 - Turn off the electrical supply to the pilot solenoid valve.

5.1.4 - Wear suitable protective equipment.

5.1.5 - Provide means of lifting and support appropriate for the maintenance operation.

Information given as an indication only, and subject to possible modifications

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		Rev.	0
		Date	07/2020

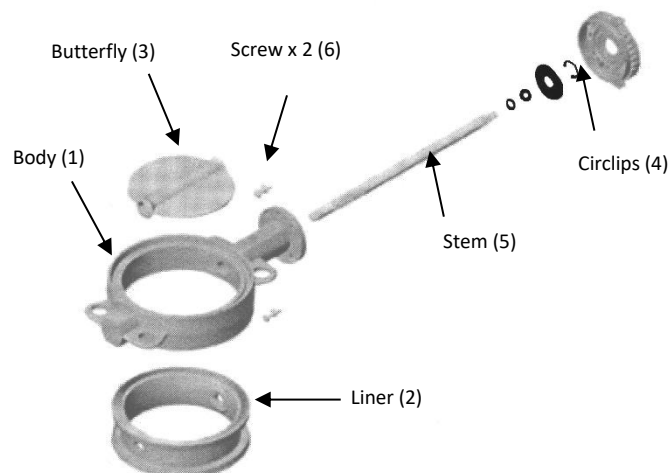
1150-1153-LT10 BUTTERFLY VALVES WITH ACTREG PNEUMATIC ACTUATOR

Maintenance:

The absence of leak at the liner and at the valve stem should be regularly checked. If a leak occurs at the stem, replace the o-ring, if it occurs at the liner, the liner has to be replaced.

Important: All maintenance and servicing operations must be performed under the best safety conditions. Before any intervention, the valve has to be removed taking the above-mentioned precautions which apply both to mounting and removal.

Worn part replacement:



Remove the motor actuator. Unscrew the screws (6), remove the circlips (4). This frees the shaft (5), thus enabling the liner (2) and the butterfly (3) to be taken out of the body (1). Replace the worn parts: To obtain the list of spare parts for every valve, please contact our technical department at: +33 (0)474 94 90 70

5.2 - Valve maintenance

In the event of a leak on the line, check the state of the butterfly (1) and of the liner (4). If need be, replace them.

Codes of spare parts:

DN	Liner					Butterfly		Stem
	EPDM	EPDM C	NBR	SILICONE	FKM	cast iron	Stainless steel	
40	985946	985966	985986		986026	9865030	9865020	9865040
50	985947	985967	985987	986007	986027	9865031	9865021	9865041
65	985948	985968	985988	986008	986028	9865032	9865022	9865042
80	985949	985969	985989	986009	986029	9865033	9865023	9865043
100	985950	985970	985990	986010	986030	9865034	9865024	9865044
125	985951	985971	985991	986011	986031	9865035	9865025	9865045
150	985952	985972	985992	986012	986032	9865036	9865026	9865046
200	985953	985973	985993	986013	986033	9865037	9865027	9865047
250	985954	985974	985994	986014	986034	9865038	9865028	9865048
300	985955					9865039	9865029	9865049

In the event of a leak at the stem, check the state of the o-rings of the stem.

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		Date	07/2020

5.3 - Actuator maintenance

Refer to the actuator's IME.

6 / HELP TO TROUBLESHOOTING

The valve stays in the closed position	Check the electrical power supply to the pilot solenoid valve
	Check the state of the coil of the pilot solenoid valve
	Check the compressed air supply
	Check the actuator's sealing
The valve stays in the open position	Check the absence of power supply to the pilot solenoid valve
	Check the absence of foreign bodies inside the slides of the pilot solenoid valve
No fluid flows in the open position	Check for clogging of the filter
	Check the upstream pressure on the pipe installation
Leak on the line when the valve is in position	Check the state of the valve seats.
Leak at the valve packing gland	Check the state of gaskets of the packing gland

7 / INSTRUCTION ON OUR PRODUCT DISPOSAL AND RECYCLING

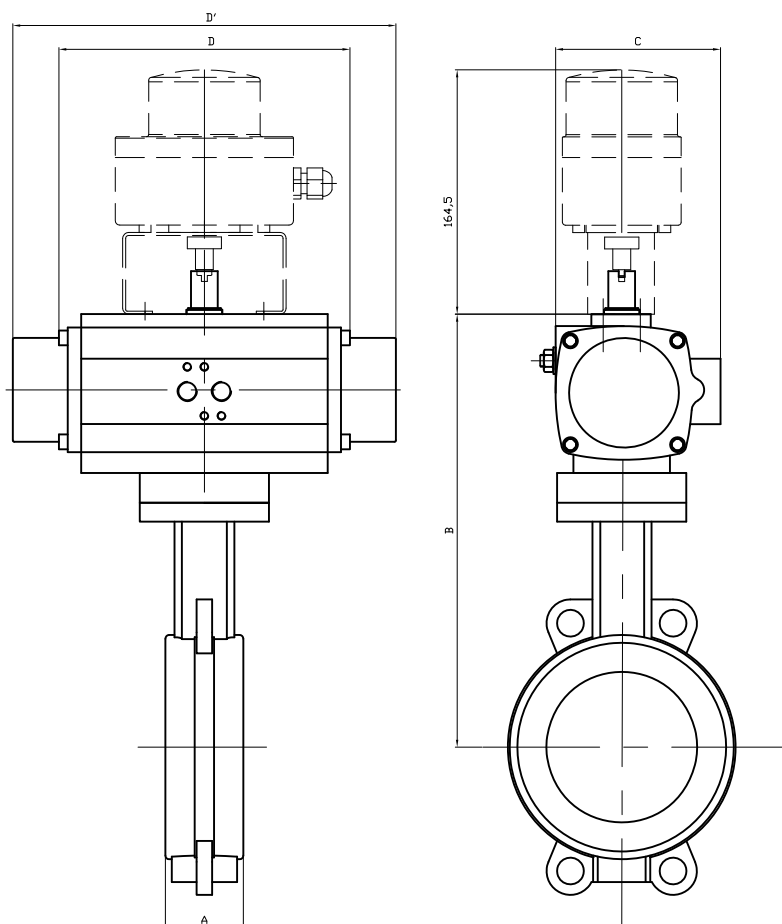
Our valve does not contain any hazardous substance. At the valve end of life, after removing the equipment, the user's obligation is to call a scrap metal collector who will sort and recycle the different parts of the equipment. For your information, the following families of metal are present in our product: steel, stainless steel and aluminium.

With regard to the electrical parts of the equipment, they have to be separated from the rest of the valve and given to a company specialised in recycling waste from electrical and electronic equipment, as per the directive 2002/96/EC.



Information given as an indication only, and subject to possible modifications

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DN	32/40		50		65		80		100		125	
ACTREG	ADA20	ASR40	ADA20	ASR40	ADA40	ASR80	ADA40	ASR80	ADA80	ASR130	ADA80	ASR200
A	33		43		46		46		52		56	
B	206	225	222	241	246	268	254	276	294	304	313	341
C	76	90	76	90	90	111	90	111	111	121	111	135
D / D'	128	230	128	230	143	260	143	260	162	270	162	335

DN	150		200		250		300		350		400	
ACTREG	ADA130	ASR300	ADA200	ASR500	ADA300	ASR500	ADA500	ASR850	ADA850	ASR1200	ADA1200	ASR2500
A	56		60		68		78		78		102	
B	332	367	390	485*	480*	497*	529*	551*	571*	599*	639*	773*
C	121	151	135	172	151	172	172	192	192	212	212	356
D / D'	184	380	202	420	236	420	270	470	320	560	439	738

* : montage avec platine de 80

Informations données à titre indicatif et sous réserve de modifications éventuelles

				Modifications cote B		06/06/2018	A
Ech:	Date :12/05/2004	Dessiné par : F.G.	Tolérances générales : +/- 0.2	Modifications		Date	REV.
VP 1150 + ACTIONNEUR ACTREG + BFC BUTTERFLY VALVE 1150 + PNEUMATIC ACTUATOR ACTREG + LIMIT SWITCH BOX				Matière :			
				Poids <Kg> :			
				Traitement : SANS			
 45, Rue du Ruisseau 38297 SAINT QUENTIN FALLAVIER				Plan n° Ens 796A			



The art of power and perfection



PNEUMATIC ACTUATORS





The art of power and perfection

RACK AND PINION
Aluminium housing

TORQUES UP TO
6,500 Nm

ACTUATORS IN
14 different sizes

We are a manufacturer of rack and pinion aluminium housing actuators with torque figures up to 6,500 Nm and scotch yoke actuators for heavy duty service up to 250,000 Nm. Our products offer reliable and dependable service for ¼ turn valves.

Engineered and built to withstand most of the applications and environmental conditions, the precision in design and quality provides a long and safe operational performance in valve control.

ACTREG has invested in quality assurance, state-of-the-art machining and testing facilities in order to assist customers in safely controlling their processes.

ACTREG engineers are happy to help you with your automation demands.



The art of power and



SCOTCH YOKE
Heavy duty service

TORQUES UP TO
250,000 Nm

ACTUATORS IN
25 different sizes

Certificates

ACTREG, S.A. has a quality Management System certified in accordance with the requirements of ISO 9001:2008 for the design, development, manufacturing and distribution of pneumatic actuators and accessories for valves. Certified by BVQI No. ESPMDD005463.

ADA/ASR 10 up to ADA/ASR 300 are classified as category SEP in accordance with the requirements of Pressure Equipment Directive 97/23/EC. ADA/ASR 500 up to ADA/ASR 4000 are classified as Category I, Procedure module A.

All ACTREG pneumatic actuators are classified for use in potentially explosive atmospheres as Group II Category 2, suitable for zones 1, 2, 21 and 22 in accordance with Annex VIII of Directive 94/9/CE (ATEX). Technical file is deposited in LCIE, No. LCIE 05 AR 022.

ACTREG pneumatic actuators have got SIL 3 (Safety integral level 3) certificate. The ACTREG actuators meets manufacturer design process requirements of Safety integral Level (SIL) 3. This is intended to achieve sufficient integrity against systematic errors of design by the manufacturer.



perfection

MAIN FEATURES & CHARACTERISTICS

1 BODY

The aluminium body is inside and outside coated with hard anodizing, with extremely abrasion resistance, low surface roughness and optimal resistance.

2 PINION

Carbon steel shaft electroless nickel plated against external and internal corrosion. Anti-blowout design.

3 ADJUSTMENT STROKE

External stroke adjustment for 5 degrees regulation, placed on the opposite side of Namur connection for better manipulation when the solenoid valve is assembled.

4 PISTONS

Pistons are coated with special treatment for corrosion resistance. Backlash is avoided by a special tooth machining. The pistons have a 3 way guide for low friction between body and pistons. The pistons are also provided with an integral guide machined between pistons and pinion.

5 POSITION INDICATOR

Multi-function indicator suitable for mechanical or inductive switches is a standard feature. Many different combinations without the need to buy external indicators.

6 SPRINGS

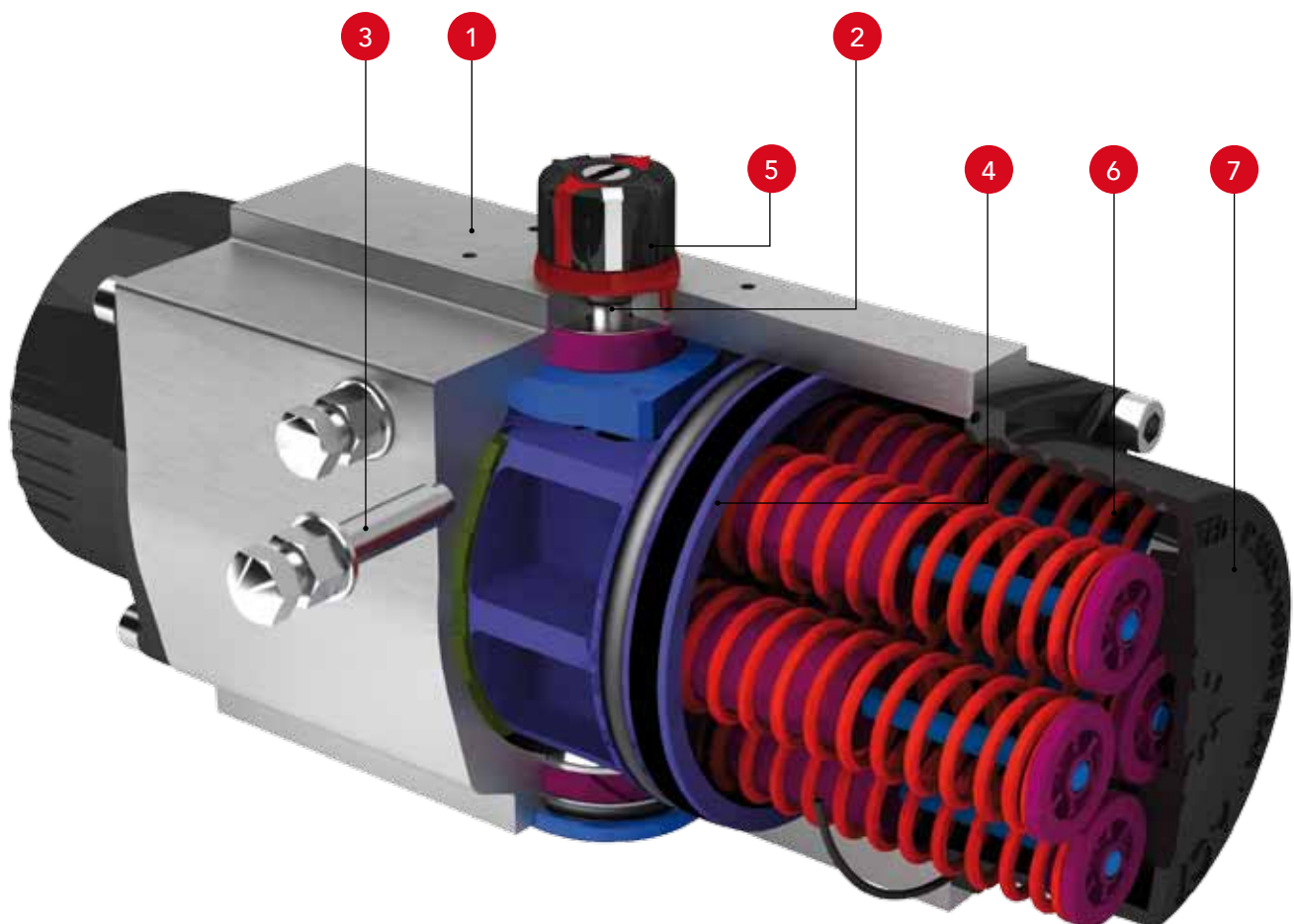
Pre-stressed springs offers more torque and different options for their positioning. This system allows us to easily fit the necessary torque to close or open the valve, offering a total safety replacement and manipulation.

7 END CAPS

Different end caps for double or single acting for fast and safety identification without the need to read the label. End caps are epoxy coated as standard protecting them against environment corrosion.

+ Every single actuator is tested and provided with a unique serial number for traceability. This heat number is stamped on the body.

+ The assembly of switch boxes, proximity switches or positioners, takes place by means of the Namur connection VDI/VDE 3845, which is a standard feature in all our models. The height of the axis to fulfil this Norm is of 30 mm, for all our products, with which it entails that with a single model of Box or positioner, we can cover all our manufacturing range.



Types of Actuators

Double Acting & Spring Return



ADA
DOUBLE
ACTING
ACTUATOR



ASR
SPRING
RETURN
ACTUATOR

Rack and pinion design | Linear torque | Rotation angle $90^\circ \pm 5^\circ$ | Antifriction sliding bearings | Long life without maintenance | Total safety for springs replacement | Mounting of solenoid valves acc. NAMUR Std. | Mounting of devices acc. NAMUR VDI/VDE 3845 Std. | Coupling according to ISO 5211 and DIN 3337 (Octagonal drive) | Multi-function position indicator suitable for mechanical and inductives direct switches.

Working temperature:

-30 °C to 100 °C in Standard Construction.

-15 °C to 150 °C with FKM O-rings (high temperature execution).

-40 °C to 80 °C with Silicone O-rings (low temperature execution).

-55° C to 80° C with Silicone O-rings and 316 pinion (extreme low temperature).

Maximum working pressure:

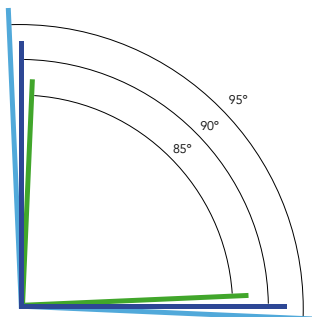
8 bar (116 psig). (Except ADA10 at 10 bar)

Bi-Directional Travel Stops

ACTREG pneumatic actuators are provided with bi-directional pinion travel stops.

Side located stops allow a full $\pm 5^\circ$ travel adjustment between 85° and 95° . These travel stops are designed to absorb the maximum rated torque of the actuator and the maximum impact loads associated with recommended travel speed.

Adjustment of the counterclockwise and clockwise rotation limits is accomplished by unscrewing the locking nuts, turning the respective left and right stop studs to reduce or increase the travel angle and screwing the locking nuts.



Options On Request

- Stainless steel pinion (grade 304 and 316).
- Fast acting actuators.
- Actuators with 100% travel adjustment stroke.
- Actuators fire proof (K-mass, blanket, other executions,...).

Coatings for special applications

Actreg Pneumatic actuators shall be protected against external corrosion resistant by proper material selection or surface treatment.

Actreg coatings are according to EN 15714-3 and are indicated to:

Standard execution

Anticorrosive C3 according EN-ISO 12944-2

PARTS & PROTECTION	DESCRIPTION	COATING
BODY	Hard anodized	25 - 30 μm
END CAPS	Epoxy painted	80 - 90 μm
STEM	Carbon steel + ENP	25 - 30 μm

Execution A1

Anticorrosive C5-I according to EN-ISO 12944-2

PARTS & PROTECTION	DESCRIPTION	COATING
BODY	Epoxy painted	80 - 90 μm
END CAPS	Epoxy painted	80 - 90 μm
STEM	SS 304	

Execution A2

Anticorrosive C5-M according to EN-ISO 12944-2

PARTS & PROTECTION	DESCRIPTION	COATING
BODY	Epoxy painted	80 - 90 μm
END CAPS	Epoxy painted	80 - 90 μm
STEM	SS 316	

Execution B

Anticorrosive C4 according to EN-ISO 12944-2

PARTS & PROTECTION	DESCRIPTION	COATING
BODY	Epoxy painted	80 - 90 μm
END CAPS	Epoxy painted	80 - 90 μm
STEM	Carbon steel + ENP	25 - 30 μm

Execution C

Anticorrosive C5-I according to EN-ISO 12944-2

PARTS & PROTECTION	DESCRIPTION	COATING
BODY	Hard anodized + ENP	25 - 30 μm
END CAPS	ENP	80 - 90 μm
STEM	Carbon steel + ENP	25 - 30 μm

Multi-function position indicator



Inductive switch indicating open or closed position



Mechanical switches indicating open and close



Inductive switches indicating open and closed position



Namur connection for direct mounting switch box



Inductive switches indicating open and closed position (45° detecting switches...)

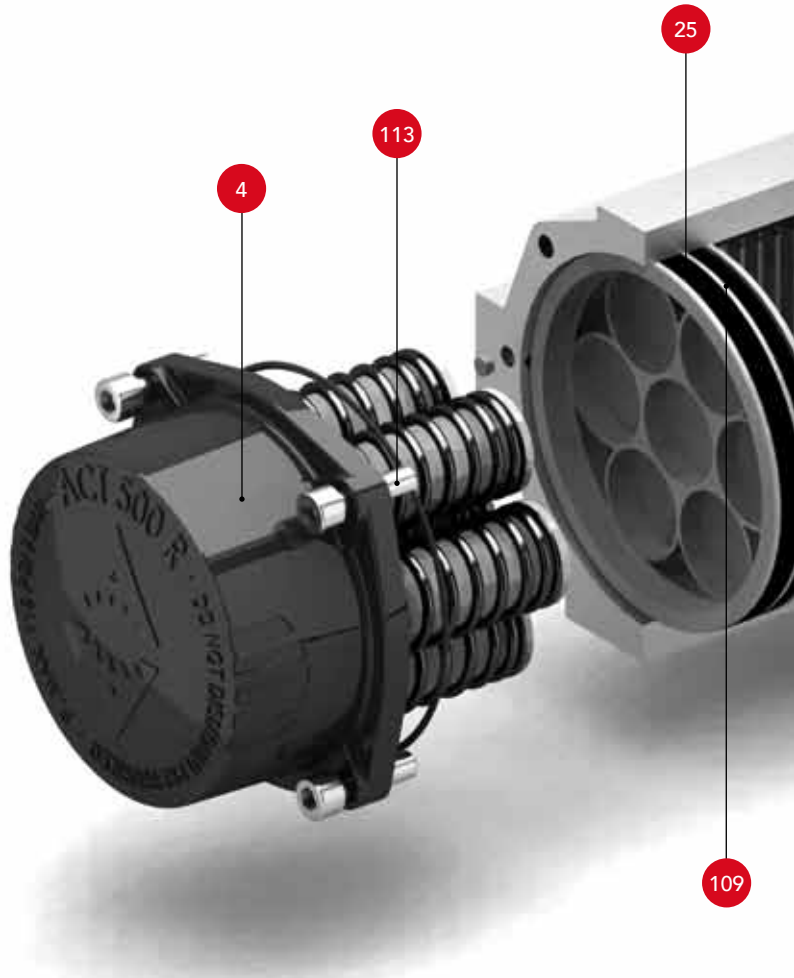


Inductive switches indicating open and closed position (up/down detecting switches...)

PARTS & MATERIALS

- 1 Body
Aluminium Hard Anodized
- 2 Piston
Aluminium
- 3 Pinion
Nickel Plated Carbon Steel
- 4 End Caps
Aluminium Epoxy Coated
- 5 Soft Pinion Washer *
Polyamide PA 6,6
- 6 Slide Piston *
Polyamide PA 6,6 + 30% G.F.
- 7 Lug **
Nickel Plated Carbon Steel
- 8 Pinion Washer
Stainless Steel
- 10 Upper Pinion Bearing
Polyamide PA 6,6 Size 500
& greater in Reinforced Br.
- 12 Stop
ASTM A 105
- 14 Spring's Long Support
Polyamide PA 6,6
- 15 Spring's Short Support
Polyamide PA 6,6
- 16 Leveling Screw
Stainless Steel
- 18 Bolt
Stainless Steel
- 19 Spring
DIN 2076 · D-5.6
- 20 Position Indicator
Polypropylene
- 21 Cam
Polypropylene
- 23 Centering Ring
Nickel Plated Carbon Steel
- 25 Slide Guide *
Polyamide PA 6,6 + 30% G.F.
- 26 Lower Pinion Bearing *
Polyamide PA 6,6
- 41 Stop Washer Pinion **
Stainless Steel
- 109 O-Ring *
NBR
- 110 O-Ring *
NBR

SPRING RETURN ACTUATOR (ASR)



- 111 O-Ring *
NBR
- 113 Bolt
Stainless Steel
- 118 O-Ring *
NBR
- 119 O-Ring *
NBR
- 125 Washer
Stainless Steel
- 471 Slip Washer *
Stainless Steel
- 934 Nut
Stainless Steel
- 985 Nut
Stainless Steel

POSITION INDICATOR

FROM SIZE 20 TO 850

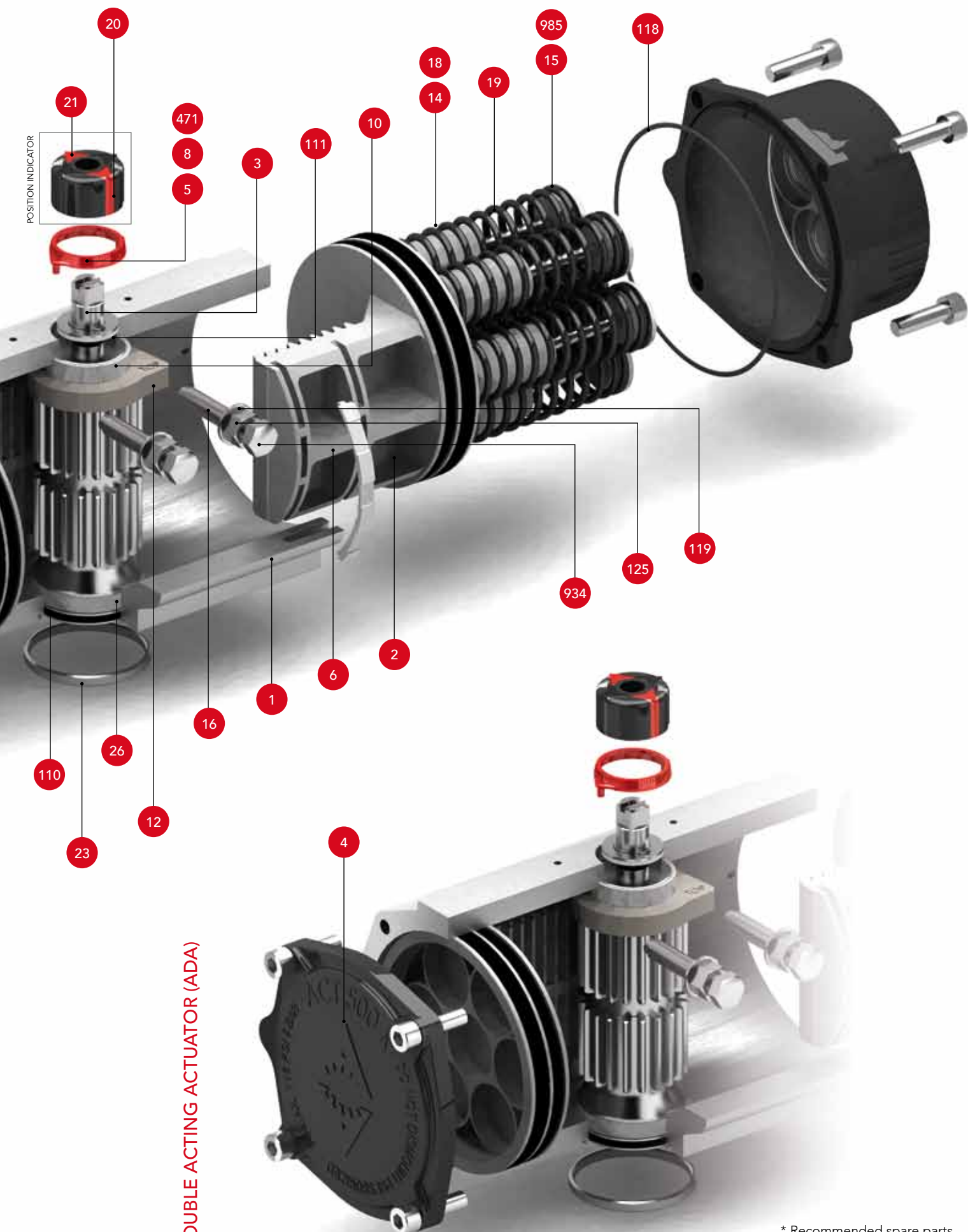


Inserts
Stainless Steel

FROM SIZE 1200 TO 4000



Position indicator & Cams
Polypropylene

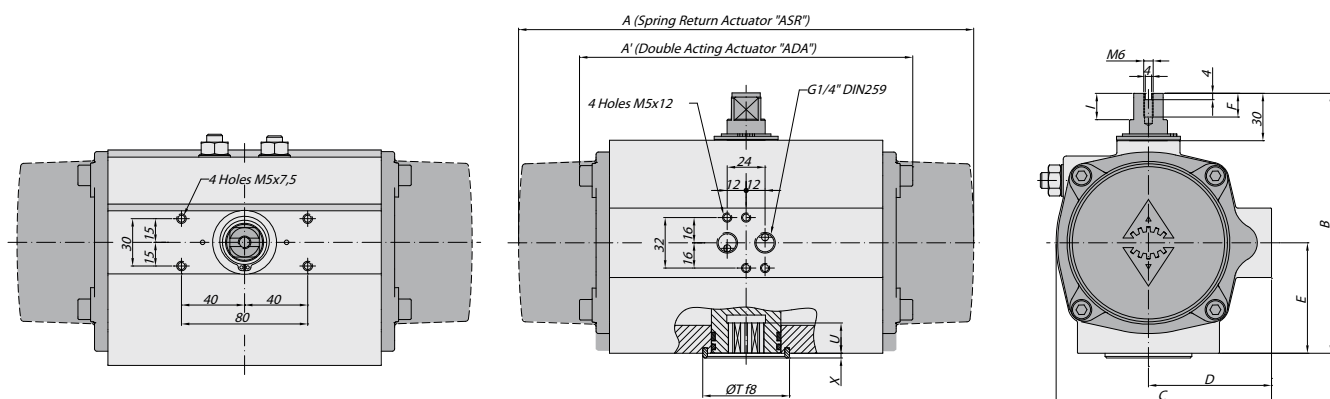


DOUBLE ACTING ACTUATOR (ADA)

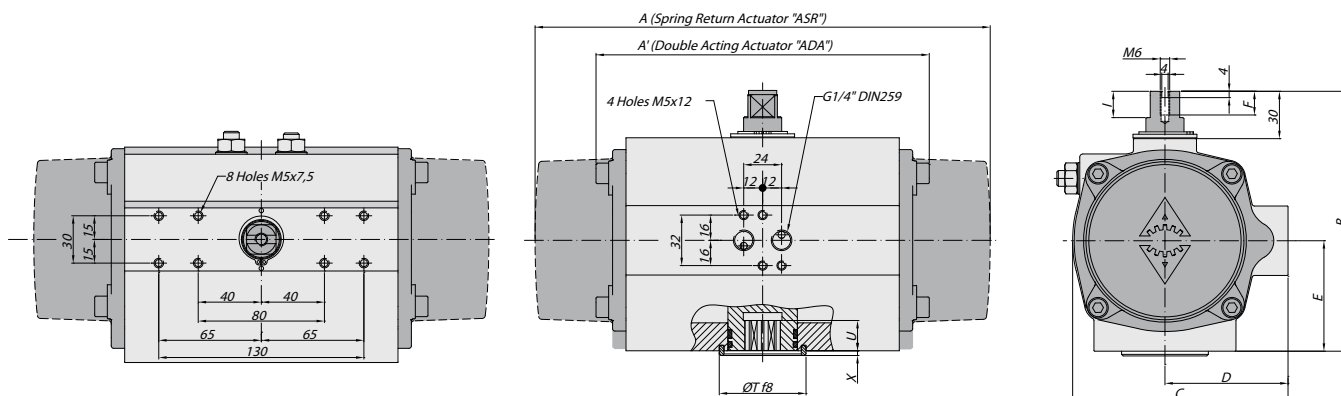
* Recommended spare parts
 ** Only for sizes 2500 & 4000

GENERAL DIMENSIONS

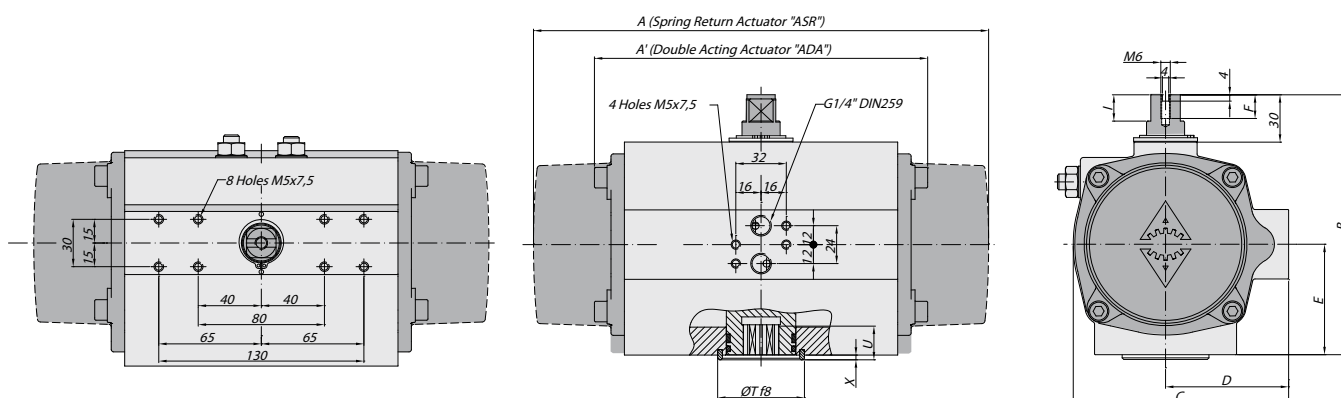
SIZES 10 | 20 | 40 | 80 | 130 | 200 | 300 | 500 | 850



SIZES 1200 | 1750



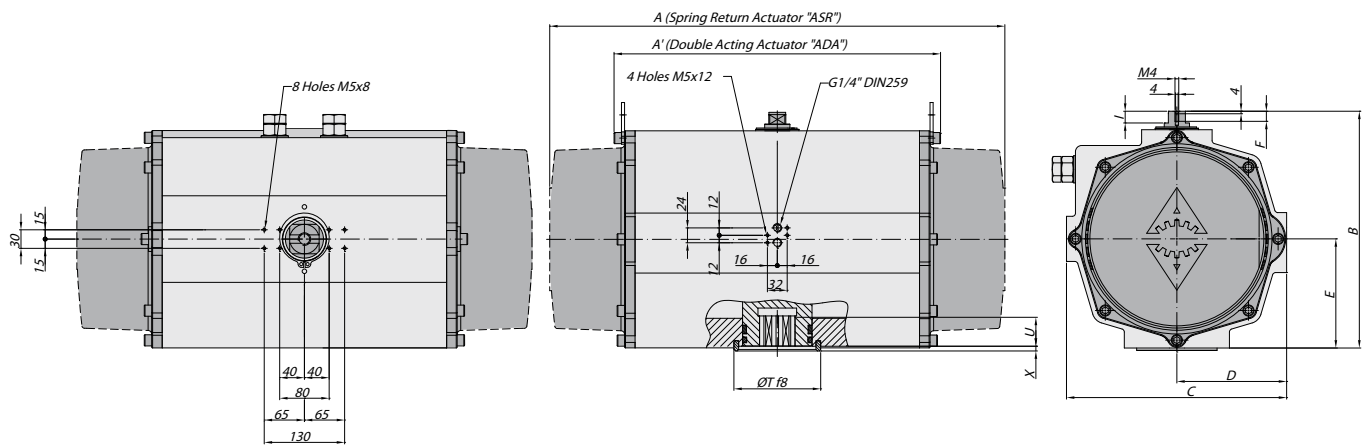
SIZES 2100



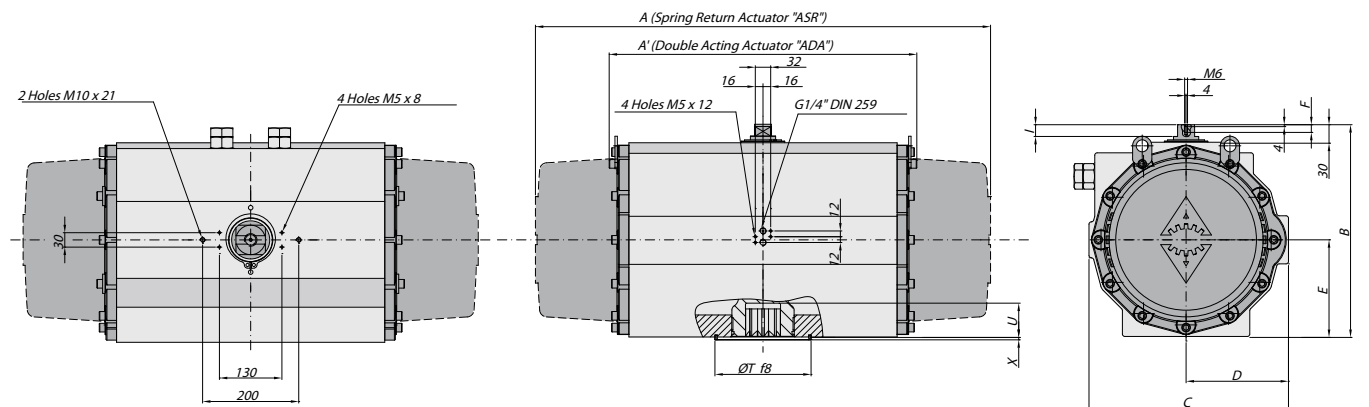
DOUBLE ACTING & SPRING RETURN ACTUATORS GENERAL DIMENSIONS in mm

SIZE	A	A'	B	C	D	E	F	I	R	øS	ISO 5211	øL	MxV	ISO 5211	øL1	M1xV1	øT	X	U
10	-	100	76	56	33	23	9	6	9	12.5	F03	36	M5x8	-	-	-	11	2	12
20	163	145	96	76	48	34	9	12.5	9	12.5	F03	36	M5x8	F05	50	M6x10	25	2	10
20	163	145	96	76	48	34	9	12.5	14	18.1	F05	50	M6x10	-	-	-	35	3	12
20	163	145	96	76	48	34	9	12.5	14	18.1	F04	42	M5x10	-	-	-	35	3	12
40	195	158	115	91	56	45	9	12.5	14	18.1	F04	42	M5x10	-	-	-	35	3	12
40	195	158	115	91	56	45	9	12.5	14	18.1	F05	50	M6x10	-	-	-	35	3	12
80	217	177	137	111	66	55	12	12.5	17	22.5	F05	50	M6x10	F07	70	M8x16	55	3	19
130	258	196	147	122	71	60	12	12.5	17	22.5	F05	50	M6x10	F07	70	M8x16	55	3	22
200	299	225	165	135.5	78	70	12	12.5	17	22.5	F07	70	M8x16	F10	102	M10x16	55	3	23

SIZES 2500



SIZES 4000



ISO 5211 DETAIL

SIZES

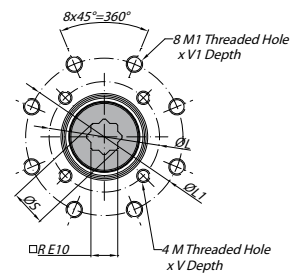
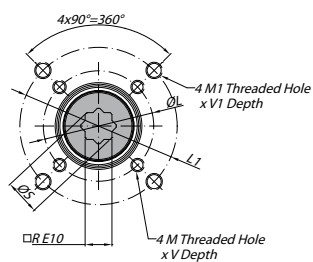
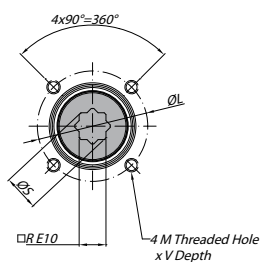
10 | 20 | 40 | 500 | 1750 | 2100 | 2500

SIZES

20 | 80 | 130 | 200 | 300 | 850 | 1200

SIZES

4000



DOUBLE ACTING & SPRING RETURN ACTUATORS GENERAL DIMENSIONS in mm

SIZE	A	A'	B	C	D	E	F	I	R	øS	ISO 5211	øL	MxV	ISO 5211	øL1	M1xV1	øT	X	U
300	348.5	273	182	152.5	86	80	12	12.5	22	28.5	F07	70	M8x16	F10	102	M10x16	70	3	24
500	397	304	199	173	96	85	12	12.5	22	28.5	F10	102	M10x16	-	-	-	70	3	32
850	473	372	221	191.5	106	98	12	12.5	27	36.5	F10	102	M10x17	F12	125	M12x20	85	3	39
1200	560	439	249	212.5	116	114	16	18.6	36	48.5	F10	102	M10x17	F14	140	M16x26	100	4	48
1750	601	461	280	242.5	131	130	16	18.6	36	48.5	F14	140	M16x26	-	-	-	100	4	50
2100	702	510	313	276.5	148	147	16	18.6	46	60.1	F16	165	M20x29	-	-	-	130	4	50
2500	738	518	383	356	177.5	176.5	16	18.6	46	60.2	F16	165	M20x29	-	-	-	130	4	58
4000	940	630	434	415	213	201	16	18.6	55	72.5	F16	165	M20x30	F25	254	M16x30	200	4	60

DOUBLE ACTING ACTUATOR TORQUE OUTPUT in Nm

Size	Output torque for double acting in Nm																				Weight (kg)		
	3 bar		3,5 bar		4 bar		4,5 bar		5 bar		5,5 bar		6 bar		6,5 bar		7 bar		8 bar			10 bar	
	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°		0°	90°
10	6		8		9		10		11		11.5		12		12		13		14		15		0.64
20	9.7		11.4		13		14.6		16.2		17.8		19.5		21.1		23		26		-		1.4
40	20.3		23.7		27.1		30.5		33.9		37.3		41		44		47		54		-		2.1
80	38.5		44.9		51.3		57.7		64.1		70.5		77		83		90		103		-		3
130	59.1		68.9		78.7		88.6		98.4		108.3		118		128		138		157		-		3.8
200	88		102		117		131		146		161		175		190		205		234		-		5.6
300	145		170		194		218		242		267		291		315		339		388		-		8.5
500	217		253		289		325		361		397		433		469		505		577		-		11.2
850	359		419		479		538		598		658		718		778		837		957		-		16.9
1200	519		606		692		779		865		952		1038		1125		1211		1384		-		25.8
1750	707		824		942		1060		1178		1295		1413		1531		1649		1884		-		32.5
2100	1086		1267		1448		1629		1810		1991		2172		2353		2534		2896		-		49.7
2500	1730		2019		2307		2596		2884		3172		3461		3749		4038		4614		-		69.6
4000	2408		2809		3210		3612		4013		4414		4816		5217		5618		6421		-		129.4

SPRING RETURN ACTUATOR TORQUE OUTPUT in Nm

Size	Type Pressure	Output torque for spring return in Nm																		Spring Stroke		Weight (kg)			
		3 bar		3,5 bar		4 bar		4,5 bar		5 bar		5,5 bar		6 bar		6,5 bar		7 bar		8 bar			END 0°	START 90°	
		0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°				
20	S04			8	5	9	7	11	8	13	10	14	12	16	13	17	15	19	17	22	20	4	7	1.51	
	S06 A									11	7	12	9	14	10	15	12	17	13	20	17	7	11	1.54	
	S08											10	5	12	7	14	9	15	10	18	14	9	15	1.56	
40	S04	16	14	20	17	23	20	26	24	30	27	33	30	37	34	40	37	43	41	50	47	5	8	2.17	
	S06	14	10	18	14	21	17	24	20	28	24	31	27	34	30	38	34	41	37	48	44	7	12	2.20	
	S08			15	10	19	14	22	17	26	20	29	24	32	27	36	30	39	34	46	41	10	16	2.23	
	S10							20	14	24	17	27	20	30	24	34	27	37	30	44	37	12	20	2.26	
	S12									21	13	25	17	28	20	32	24	35	27	42	34	15	24	2.29	
	S14 A											23	13	26	17	30	20	33	24	40	30	17	28	2.32	
80	S04	31	27	38	34	44	40	50	46	57	53	63	59	70	66	76	72	82	78	95	91	9	13	3.28	
	S06	27	21	34	28	40	34	47	41	53	47	59	53	66	60	72	66	79	73	92	86	13	20	3.36	
	S08					37	29	43	35	49	41	56	48	62	54	69	61	75	67	88	80	17	27	3.43	
	S10							39	29	46	36	52	42	59	49	65	55	71	61	84	74	22	33	3.51	
	S12									42	30	48	36	55	43	61	49	68	56	81	69	26	40	3.58	
	S14 A											45	31	51	37	58	44	64	50	77	63	30	47	3.65	
130	S06	43	36	52	46	62	56	72	65	82	75	92	85	102	95	111	105	121	115	141	134	19	27	4.40	
	S08			47	38	57	48	67	58	76	68	86	77	96	87	106	97	116	107	135	127	26	36	4.50	
	S10					51	40	61	50	71	60	81	70	91	80	100	89	110	99	130	119	32	45	4.60	
	S12							56	42	65	52	75	62	85	72	95	82	105	92	124	111	39	54	4.70	
	S14 A											70	54	80	64	89	74	99	84	119	103	45	64	4.80	
200	S06	61	49	76	63	90	78	105	92	119	107	134	122	149	136	163	151	178	166	207	195	31	46	6.50	
	S08			67	50	81	65	96	79	111	94	125	109	140	123	154	138	169	152	198	182	42	61	6.70	
	S10					72	52	87	66	102	81	116	96	131	110	146	125	160	139	189	169	52	77	6.90	
	S12							78	53	93	68	107	83	122	97	137	112	151	126	180	156	63	92	7.00	
	S14 A											99	70	113	84	128	99	142	113	172	143	73	107	7.30	
300	S06	102	75	126	99	151	123	175	148	199	172	223	196	247	220	272	245	296	269	344	317	51	83	9.65	
	S08			112	76	136	100	160	124	185	148	209	173	233	197	257	221	281	245	330	294	68	111	9.92	
	S10					122	76	146	101	170	125	194	149	219	173	243	198	267	222	315	270	85	138	10.20	
	S12							131	77	156	101	180	126	204	150	228	174	253	198	301	247	102	166	10.50	
	S14 A											165	102	190	126	214	151	238	175	287	223	119	193	10.80	
500	S06	152	119	188	155	224	191	260	227	296	263	333	299	369	335	405	371	441	407	513	480	76	115	13.33	
	S08	131	86	167	122	203	158	239	194	275	231	311	267	347	303	383	339	419	375	492	447	101	153	13.84	
	S10					181	126	217	162	254	198	290	234	326	270	362	306	398	342	470	414	126	192	14.35	
	S12							196	129	232	165	268	201	304	238	340	274	376	310	449	382	152	230	14.85	
	S14 A											247	169	283	205	319	241	355	277	427	349	177	268	15.36	
850	S06	260	209	320	269	380	328	440	388	500	448	559	508	619	568	679	627	739	687	858	807	116	177	19.7	
	S08	227	159	287	218	347	278	407	338	467	398	526	458	586	518	646	577	706	637	826	757	155	236	20.3	
	S10			254	168	314	228	374	288	434	348	494	408	553	467	613	527	673	587	793	707	193	295	20.9	
	S12							341	238	401	298	461	358	521	417	580	477	640	537	760	657	232	353	21.6	
	S14 A											428	307	488	367	547	427	607	487	727	607	271	412	22.2	
1200	S06	373	289	460	376	546	462	633	549	720	635	806	722	893	808	979	895	1066	981	1239	1154	171	271	30.1	
	S08	325	213	411	299	498	386	584	472	671	559	758	645	844	732	931	818	1017	905	1190	1078	229	361	31.1	
	S10	276	136	363	222	449	309	536	395	622	482	709	569	795	655	882	742	969	828	1142	1001	286	451	32.2	
	S12					401	232	487	319	574	405	660	492	747	578	833	665	920	751	1093	924	343	541	33.2	
	S14 A									525	329	612	415	698	502	785	588	871	675	1044	848	400	631	34.3	
1750	S06	477	349	595	466	712	584	830	702	948	820	1066	937	1183	1055	1301	1173	1419	1291	1654	1526	270	421	39.3	
	S08	400	229	518	347	636	465	754	582	871	700	989	818	1107	936	1225	1053	1342	1171	1578	1407	360	562	41.0	
	S10			441	228	559	345	677	463	795	581	912	699	1030	816	1148	934	1266	1052	1501	1287	451	702	42.7	
	S12							600	344	718	461	836	579	954	697	1071	815	1189	933	1425	1168	541	843	44.4	
	S14 A									642	342	759	460	877	578	995	695	1113	813	1348	1049	631	983	46.0	
2100	S06	702	509	883	690	1064	871	1245	1052	1426	1233	1607	1414	1788	1595	1969	1776	2150	1957	2512	2319	384	577	60.3	
	S08	574	316	755	497	936	678	1117	859	1298	1040	1479	1221	1660	1402	1841	1583	2022	1764	2384	2126	512	770	62.5	
	S10			627	305	808	486	989	667	1170	848	1351	1029	1532	1210	1713	1391	1894	1572	2256	1934	640	962	64.2	
	S12							861	474	1042	655	1223	836	1404	1017	1585	1198	1766	1379	2128	1741	768	1154	66.3	
	S14 A									914	463	1095	644	1276	825	1457	1006	1638	1187	2000	1549	896	1347	68.0	
2500	S06	1299	1045	1587	1333	1876	1622	2164	1910	2453	2199	2741	2487	3029	2735	3318	3064	3606	3352	4183	3929	508	806	85.9	
	S08	1155	816	1444	1105	1732	1393	2020	1682	2309	1970	2597	2258	2886	2547	3174	2835	3462	3124	4039	3700	677	1075	89.4	
	S10			1300	876	1588	1165	1877	1453	2165	1742	2453	2030	2742	2318	3030	2607	3319	2895	3895	3472	846	1344	92.9	
	S12					1444	936	1733	1225	2021	1513	2310	1802	2598	2090	2886	2378	3175	2667	3752	3243	1015	1613	96.4	
	S14 A							1589	996	1877	1285	2166	1573	2454	1861	2742	2150	3031	2438	3608	3015	1184	1882	99.9	
4000	S06	1763	1262	2165	1663	2566	2065	2967	2466	3369	2867	3770	3269									758	1348	158.7	
	S08	1549	880	1950	1282	2351	1683	2752	2084	3154	2485	3555	2887	3956	3288	4358	3689	4759	4091	5068	4399	1011	1797	164.7	
	S10					2136	1301	2538	1702	2939	2104	3340	2505	3742	2906	4143	3307	4544	3709	4853	4017	1264	2246	170.8	
	S12									2323	1320	2724	1722									1516	2696	176.9	
	S14 A													2911	1741	3312	2142	3713	2544	4115	2945	4423	3254	1769	3145

DOUBLE ACTING ACTUATOR TORQUE OUTPUT in ft lb

Size	Output torque for double acting in ft lb																		Weight (lb)				
	43.5 psi		50.8 psi		58 psi		65.3 psi		72.5 psi		80 psi		87 psi		94.3 psi		102 psi			116 psi		145 psi	
	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°		0°	90°	0°	90°
10	4.4		6		6.5		7.4		8		8.5		9		9		9.5		10.3		12		1.4
20	7.2		8.4		9.6		10.8		11.9		13.1		14.4		15.6		17		19.2		-		3.1
40	15.0		17.5		20.0		22.5		25.0		27.5		30.2		32.4		34.6		39.8		-		4.6
80	28.4		33.1		37.8		42.5		47.2		52.0		56.7		61.2		66		76		-		6.6
130	43.6		50.8		58.0		65.3		72.5		79.8		87		94		102		116		-		8.4
200	64.9		75.2		86.2		96.5		108		119		129		140		151		172		-		12.3
300	107		125.3		143		161		178		197		214		232		250		286		-		18.7
500	160		186		213		240		266		293		319		346		372		425		-		24.7
850	265		309		353		397		441		485		529		573		617		705		-		37.3
1200	383		447		510		574		638		702		765		829		893		1020		-		56.9
1750	521		607		694		781		868		954		1041		1128		1215		1389		-		71.6
2100	801		934		1068		1201		1335		1468		1602		1735		1869		2136		-		109.5
2500	1275		1488		1700		1913		2126		2338		2551		2763		2976		3401		-		153.4
4000	1775		2070		2366		2662		2958		3253		3549		3845		4140		4732		-		285.3

SPRING RETURN ACTUATOR TORQUE OUTPUT in lb

Size	Type Pressure	Output torque for spring acting in ft lb																		Spring Stroke		Weight (lb)		
		43.5 psi		50.8 psi		58 psi		65.3 psi		72.5 psi		80 psi		87 psi		94.3 psi		102 psi		116 psi				
		0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°		END 0°	START 90°
20	S04			6	4	7	5	8	6	9	7	10	9	12	10	13	11	14	12	16	15	3	5	3.33
	S06 A									8	5	9	6	10	8	11	9	13	10	15	12	5	8	3.40
	S08											8	4	9	5	10	6	11	8	14	10	7	11	3.44
40	S04	12	10	14	12	17	15	19	17	22	20	24	22	27	25	29	27	32	30	37	35	4	6	4.78
	S06	10	7	13	10	15	12	18	15	21	18	23	20	25	22	28	25	30	27	35	32	5	9	4.85
	S08			11	7	14	10	16	12	19	15	21	18	24	20	27	22	29	25	34	30	7	12	4.92
	S10							15	10	18	13	20	15	22	18	25	20	27	22	32	27	9	15	4.98
	S12									15	10	18	13	21	15	24	18	26	20	31	25	11	18	5.05
80	S14 A											17	10	19	13	22	15	24	18	29	22	13	21	5.11
	S04	23	20	28	25	32	29	37	34	42	39	46	43	52	49	56	53	60	57	70	67	6	10	7.23
	S06	20	16	25	21	30	25	35	30	39	35	43	39	49	44	53	49	58	54	68	63	10	15	7.41
	S08					27	21	32	26	36	30	41	35	46	40	51	45	55	49	65	59	13	20	7.56
	S10							29	21	34	27	38	31	43	36	48	41	52	45	62	55	16	25	7.74
130	S12									31	22	35	27	41	32	45	36	50	41	60	51	19	29	7.89
	S14 A											33	23	38	27	43	32	47	37	57	46	22	34	8.05
	S06	31	26	39	34	46	41	53	48	60	55	68	63	75	70	82	77	89	85	104	99	14	20	9.70
	S08			35	28	42	35	49	43	56	50	63	57	71	64	78	71	85	79	99	94	19	27	9.92
	S10					38	29	45	37	52	44	60	52	67	59	74	66	81	73	96	88	24	33	10.14
200	S12							41	31	48	38	55	46	63	53	70	60	77	68	91	82	29	40	10.36
	S14 A											52	40	59	47	66	55	73	62	88	76	33	47	10.58
	S06	45	36	56	46	66	57	77	68	88	79	99	90	110	100	120	111	131	122	153	144	23	34	14.33
	S08			49	37	60	48	71	58	82	69	92	80	103	91	113	102	125	112	146	134	31	45	14.77
	S10					53	38	64	49	75	60	85	71	97	81	108	92	118	102	139	125	38	56	15.21
300	S12							57	39	69	50	79	61	90	71	101	83	111	93	133	115	46	68	15.43
	S14 A											73	52	83	62	94	73	105	83	127	105	54	79	16.09
	S06	75	55	93	73	111	91	129	109	147	127	164	144	182	162	200	181	218	198	254	234	38	61	21.27
	S08			83	56	100	74	118	91	136	109	154	128	172	145	189	163	207	181	243	217	50	81	21.87
	S10					90	56	108	74	125	92	143	110	161	128	179	146	197	164	232	199	63	102	22.49
500	S12							97	57	115	74	133	93	150	111	168	128	186	146	222	182	75	122	23.15
	S14 A											122	75	140	93	158	111	175	129	212	164	88	143	23.81
	S06	112	88	139	114	165	141	192	167	218	194	245	220	272	247	298	273	325	300	378	354	56	85	29.39
	S08	97	63	123	90	150	116	176	143	203	170	229	197	256	223	282	250	309	276	363	329	74	113	30.51
	S10					133	93	160	119	187	146	214	172	240	199	267	226	293	252	346	305	93	141	31.64
850	S12							144	95	171	122	198	148	224	175	251	202	277	228	331	282	112	170	32.74
	S14 A											182	125	209	151	235	178	262	204	315	257	130	198	33.86
	S06	192	154	236	198	280	242	324	286	369	330	412	374	456	419	500	462	545	506	632	595	85	130	43.43
	S08	167	117	212	161	256	205	300	249	344	293	388	338	432	382	476	425	520	469	609	558	114	174	44.75
	S10			187	124	231	168	276	212	320	256	364	301	408	344	452	388	496	433	584	521	143	217	46.08
1200	S12							251	175	296	220	340	264	384	307	427	352	472	396	560	484	171	260	47.62
	S14 A											315	226	360	270	403	315	447	359	536	447	200	304	48.94
	S06	275	213	339	277	402	340	467	405	531	468	594	532	658	595	722	660	786	723	913	850	126	199	66.36
	S08	240	157	303	220	367	284	430	348	495	412	559	475	622	539	686	603	750	667	877	794	168	266	68.56
	S10	203	100	268	164	331	228	395	291	458	355	523	419	586	483	650	547	714	610	842	738	210	332	70.99
1750	S12					296	171	359	235	423	298	486	363	551	426	614	490	678	553	806	681	253	399	73.19
	S14 A									387	242	451	306	514	370	579	433	642	497	769	625	295	465	75.62
	S06	352	257	439	343	525	430	612	517	699	604	786	691	872	778	959	865	1046	951	1219	1125	199	310	86.64
	S08	295	169	382	256	469	343	556	429	642	516	729	603	816	690	903	776	989	863	1163	1037	265	414	90.39
	S10			325	168	412	254	499	341	586	428	672	515	759	601	846	688	933	775	1106	949	332	517	94.14
2100	S12							442	254	529	340	616	427	703	514	789	601	876	688	1050	861	399	621	97.88
	S14 A									473	252	559	339	646	426	733	512	820	599	993	773	465	724	101.41
	S06	518	375	651	509	785	642	918	776	1052	909	1185	1043	1319	1176	1452	1310	1586	1443	1853	1710	283	426	132.28
	S08	423	233	557	367	690	500	824	634	957	767	1091	901	1224	1034	1358	1168	1491	1301	1758	1568	378	568	136.69
	S10			462	225	596	358	729	492	863	625	996	759	1130	892	1263	1026	1397	1159	1646	1426	472	710	141.09
2500	S12							635	350	768	483	902	617	1035	750	1169	884	1302	1017	1569	1284	566	851	145.50
	S14 A									674	341	808	475	941	608	1074	742	1208	875	1475	1142	661	993	149.91
	S06	957	770	1170	982	1383	1195	1595	1408	1808	1621	2020	1833	2232	2045	2445	2258	2658	2470	3083	2896	374	594	189.38
	S08	851	601	1064	814	1276	1027	1489	1240	1702	1452	1914	1664	2127	1877	2339	2089	2551	2302	2977	2727	499	792	197.09
	S10			958	646	1170	859	1383	1071	1596	1284	1808	1496	2021	1708	2233	1921	2446	2134	2871	2559	624	991	204.81
4000	S12					1064	690	1277	903	1489	1115	1702	1328	1915	1540	2127	1753	2340	1966	2765	2390	748	1189	212.52
	S14 A							1171	734	1383	947	1596	1159	1809	1372	2021	1585	2234	1797	2659	2222	873	1387	220.24
	S06	1299	930	1596	1226	1891	1522	2187	1817	2483	2113	2778	2409									559	993	349.87
	S08	1142	649	1437	945	1733	1240	2028	1536	2324	1831	2620	2128	2916	2423	3212	2719	3507	3015	3735	3242	745	1323	363.10
	S10					1574	959	1871	1254	2166	1551	2462	1846	2758	2142	3053	2437	3349	2734	3577	2961	932	1655	376.55
S12								1712	973	2008	1269	2303	1565	2599	1860	2895	2156	3190	2452	3418	2680	1117	1987	389.99
	S14 A											2145	1283	2441	1579	2736	1875	3033	2170	3260	2398	1304	2318	403.22