


USER MANUAL FOR SUBSEA COMPENSATORS 0,03-3 LITER

Document title : *UMA-6231-XXX Subsea Compensators*
IKM TECHNOLOGY AS ref. : *P6231*
Customer ref. : *Subsea Tool*




IKM Technology AS

Rev.	Date	Reason For Issue	Prepared	Checked	Approved
01	31.01.13	Issued for review	JHR	EN	KG
02	13.06.16	Update	KF	RK	KF

BTE.12-26 User Manual			Page 2 of 20	
Dok.ID:	010984	Issue date:	2014.12.29	
Approved date:	2015.02.13	Rev.no:	002	
Author:	Gabrielsen Trine (Technique)	Owner:	IKM Administrator	
Approved by:	Reinsnos Jostein (Technique)	Company:	IKM Technique AS	

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1 GENERAL INFORMATION

The purpose of this manual is to guide and safeguard users of IKM Technology range of compensators. Models covered by this manual are 0.03 liter, 0.3 liter, 1.0 liter, 2.0 liter and 3.0 liter types. Please note that all IKM Technique compensators are designed, tested and used for compensation of oilfilled cavities on temporary subsea equipment as ROV's and ROT's of various types and models. The purposes of a compensator by these means are to provide a given volume and pressure for oilfilled subsea equipment. Variants of the different models will occur. Thus will the main and important issues on safety, parts and use be the same.


WARNING

All spring loaded compensators are under load, often high spring forces.

Injury and damage to personnel and equipment can occur if work (dismantling) of the compensator is performed outside the procedure described in this manual.


Fluid inside a compensator is normally under pressure. Take care to release pressure before opening fittings.

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1.1 Abbreviations


HPU	Hydraulic Power Unit
ROV	Remotely Operated Vehicle
kg	Kilo gram
mm	Milli meter
BSP	British standard pipe
JIC	Joint industry council
CCM	Cubic centimeter
LPM	Liter per minute
Nm	Newton meter
CCW	Counter clockwise
ml	Milli liter

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1.2 References

Doc nr	Description	Rev.	Issued	Can be found
6231-XXX	Drawings of respective compensators			Appendix A

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2 TECHNICAL SPESIFICATION

The Subsea Compensators main components are the frame/housing, fluid reservoir (bellow) and spring. Material used is POM-C, stainless steel and rubber. Empty compensator sensor (electrical) is optional for some compensators.

Recommended direction for installation is vertical (so that extension happens in vertical direction).

Capacity	Part Number	Dimensions	Weight	Fluid	Pressure
30 ml	6231-010	Ø 58 mm Max length 114 mm Min length 81 mm	In air: 0,13 kg In water: 0,04 kg	Mineral oil	10%: 0,05 bar 90%: 0,8 bar
0,3 liter	6231-001	Ø 130 mm Max length 218 mm Min length 153 mm	In air: 2,64 kg In water: 1,85 kg	Mineral oil	10%: 0,2 bar 90%: 1,2 bar
1 liter	6231-008	Ø 160mm Max length 398 mm Min length 297 mm	In air: 3,74 kg In water: 2,03 kg	Mineral oil	10%: 0,1 bar 90%: 0,6 bar
2 liter	6231-003	Ø 160mm Max length 781 mm Min length 579 mm	In air: 6,62 kg In water: 3,48 kg	Mineral oil	10%: 0,1 bar 90%: 0,6 bar
3 liter	6231-000	Ø 246mm Max length 462 mm Min length 332 mm	In air: 9,44 kg In water: 4,74 kg	Mineral oil	10%: 0,2 bar 90%: 0,4 bar

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3 SAFETY

3.1 General – Operations

Only authorised people and qualified personnel should work on the system, and take suitable precautions to prevent any potential injuries. Always adhere to authorised working practices, and use the correct tools for the job. To facilitate this, make sure that these are available before commencing the test.

Ensure that the working area is kept clear and uncluttered.

3.2 General – Hydraulic

Do not work on pressurised systems. Hydraulic systems contain a large amount of stored energy when pressurised, therefore the system (including any accumulators) should be de-pressurised, and the power pack switched off, prior to working on the system. Exceptions to this would be system adjustments to components requiring the presence of pressure and/or flow.

Any personnel authorised to work on the system must have a complete understanding of the operation of the hydraulic system, so that they will be aware of any system liable to remain pressurised or hazardous in any other way. Ensure that all personnel are clear of any mechanical/hydraulic system likely to move if pressure to system actuators is released or applied.

Do not attempt to tighten any leaking fittings whilst under pressure. A hose/fitting rupture could result, leading to injury from flying components and/or oil jets.

Regularly inspect fittings and pipe-work for mechanical damage. If any such damage is found, the item must be repaired or replaced as necessary before pressure is applied to the system. Do not allow damaged fittings to remain in service.

Take care when inspecting, commissioning, repairing or maintaining the system to avoid jets of oil issuing from open orifices; pipe ends etc. if pressure is applied. Particular care should be taken to protect the eyes.

Hydraulic components may be heavy and slippery when covered in oil. Ensure that adequate protective clothing and footwear is used.


Any moving component should be treated with caution when the system is pressurised during operation, and especially during on-deck testing and repair. Keep clear of all moving components, and take all necessary precautions to avoid injury when working on these systems by preventing movement of any components likely to cause injury.

3.3 General – Mechanical

Beware of and keep clear of all moving components. Do not work on the system whilst power is applied, or if there is any potential for components to move.

Ensure that all load bearing components are adequately and regularly inspected. If damage is found the component must be repaired/replaced as necessary. Do not allow damaged components to remain in service.

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Always ensure that items are correctly and adequately supported before removal, and that authorised lifting equipment and procedures are used.

Note: trying to lift heavy components in an awkward position by hand without the assistance of correct lifting equipment, or lifting any component without adopting the correct stance, can lead to serious injury.

Ensure that when working within or underneath the machine that your presence is known to your supervisor. If working underneath the machine, always ensure that there are no loose or unsupported assemblies, components or tools above.

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4 ASSEMBLY DESCRIPTION

- The compensator shall be coupled with the fluid/oil filled circuit/storage.
- The compensators do only have one open bellow so the in- and outlet is freely selectable.
- It is strongly recommended to install the compensators in an upwards position (vertical). Especially if there is a lot of sand and dirt in the operating area subsea. If the compensator is installed in a horizontal position layers of dirt can be built up under the bellow and make a hole in it.
- Make sure to have enough space under the compensator so the indicator shaft can move freely.
- Fill up the compensator $\frac{1}{4}$ to $\frac{3}{4}$ full and get out all of the air in the system. The level in the compensator depends a lot on what it is connected to. Is there a great change in volume (ex. Cylinder), is it a big variety in the heat of the fluid (ex. Motor, pressure) or is it simply a fluid filled cavity. All these points must be taken under consideration before choosing a fluid level.

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5 MAINTENANCE

Dismantling of compensators

30 ml type, ref GA dwg 6231-010

1. Make sure all internal pressure is released from compensator
2. Remove housing parts from each other, item 3 & 4

Note:

Be aware of oil spill.

3. Retract bellow (item 5) and piston (item 1 & 2) from hosing (item 3).
4. The compensator is now separated and bellow available for close inspection.
5. In case of replacing bellow, no more dismantling is required.
6. Install new bellow in same location and orientation as the removed unit

0.3 liter type, ref GA dwg 6231-001

1. Make sure all internal pressure is released from compensator
2. Loosen 8 off M6 nuts & bolts, item 11 & 12
3. Make sure the spring pressure is low and stable
4. Unscrew 8 off M6 nuts & bolts. item 11 & 12

Note:

Be aware of oil spill.

5. Retract bellow (item 5) and indicator pins (item 4) from hosing (item 1).
6. The compensator is now separated and bellow available for close inspection.
7. In case of replacing bellow, no more dismantling is required.
8. Install new bellow in same location and orientation as the removed unit

1 liter type, ref GA dwg 6231-008

1. Make sure all internal pressure is released from compensator
2. Loosen 8 off M8 nuts & bolts, item 14 to 16
3. Make sure the spring pressure is low and stable
4. Unscrew 8 off M8 nuts & bolts. item 14 to 16

Note:

Be aware of oil spill.


5. Retract piston, item 1
6. Retract bellow and spring assy, item 12 & 13
7. Remove bellow for close visual inspection by unscrew 3 off M4 screws, item 3
8. Replace bellow as required.
9. Clean all parts properly and remove all traces of sand & silt

2 liter type, ref GA dwg 6231-003 (Two of 1 liter compensator)

3 liter type, ref GA dwg 6231-000

1. Make sure all internal pressure is released from compensator
2. Loosen 8 off M8 nuts & bolts, item 13 to 15

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3. Make sure the spring pressure is low and stable
4. Unscrew 8 off M8 nuts & bolts. item 13 to 15

Note:

Be aware of oil spill.

5. Retract compensator piston with bellow, item 12
6. Retract spring
7. Remove bellow for close visual inspection by unscrewing 3 off M5 screws, item 6.
8. Replace bellow as required.
9. Clean all parts properly and remove all traces of sand & silt

Assembly of compensators

All procedures above to be reversed


- Clean the compensators with fresh water after use and apply a light layer with WD40 or similar.
- Check for any irregularities.

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6 SPARE PART LIST

- Spring
- Bellow.
- Nuts and bolts.
-

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7 REVISION CHANGES


Revision	Procedure change	Author
01	<i>Original version</i>	JHR
02	<i>Update</i>	KF

8 CONTACT INFORMATION

All enquiries relating to the tooling should be addressed to:

IKM Technology AS
 Nordlysveien 7,
 N-4340 Bryne
 Norway

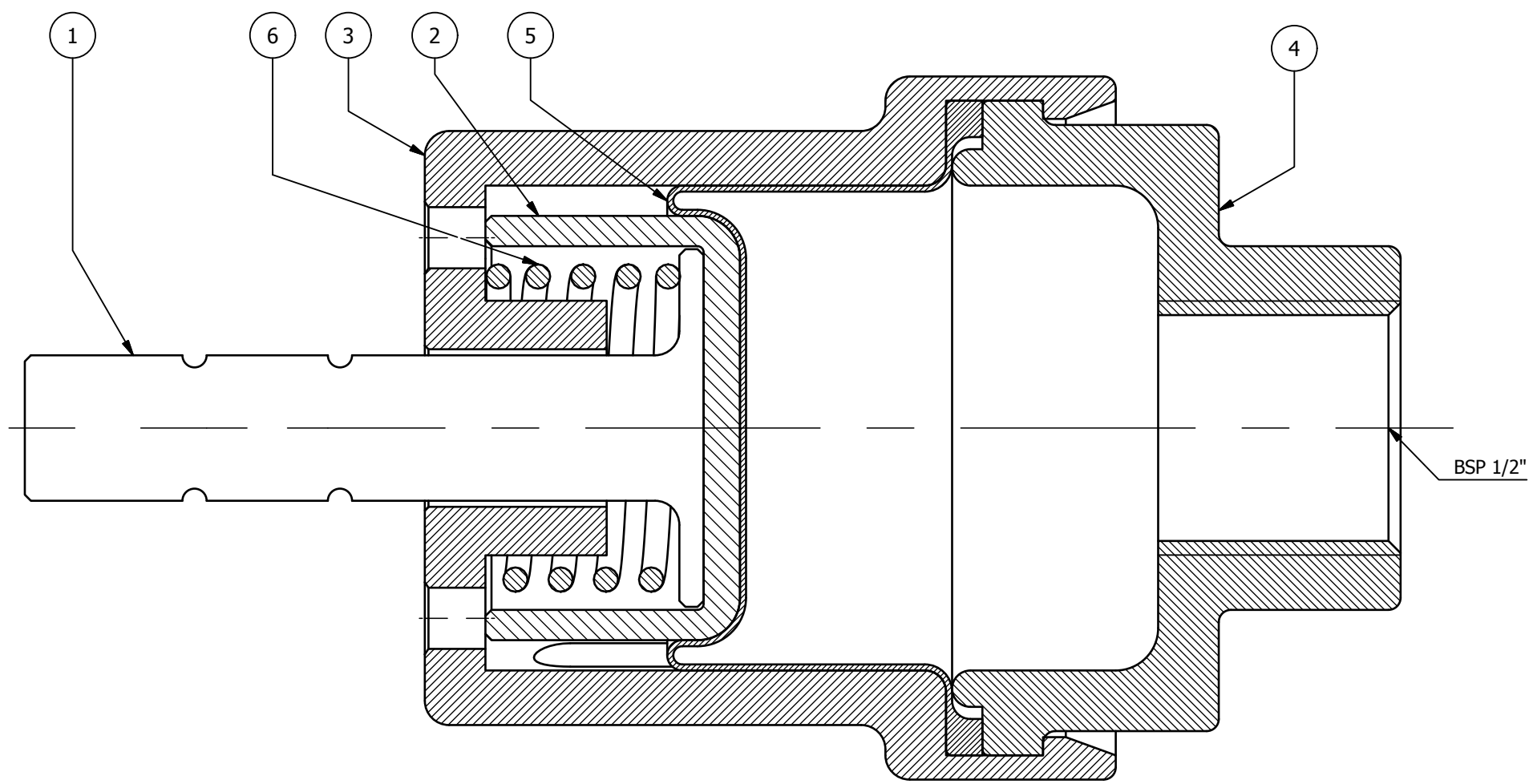
Phone, 24/7 : +47 51 80 05 20
 Mail : IKMtechnology@IKM.no

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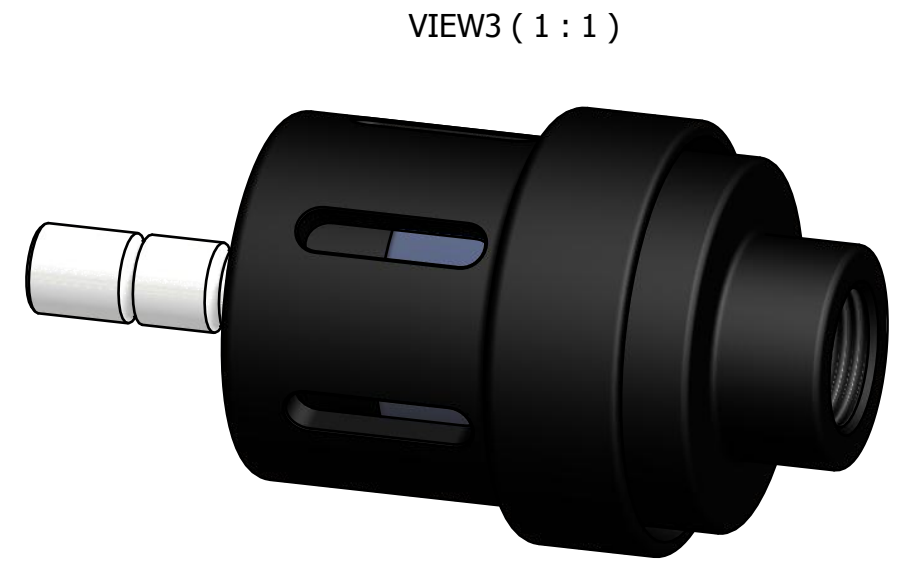
9 APPENDIX

	Doc number	Description	Rev
<i>Appendix A</i>	6231-XXX	<i>Drawings of Compensators</i>	
<i>Appendix B</i>			

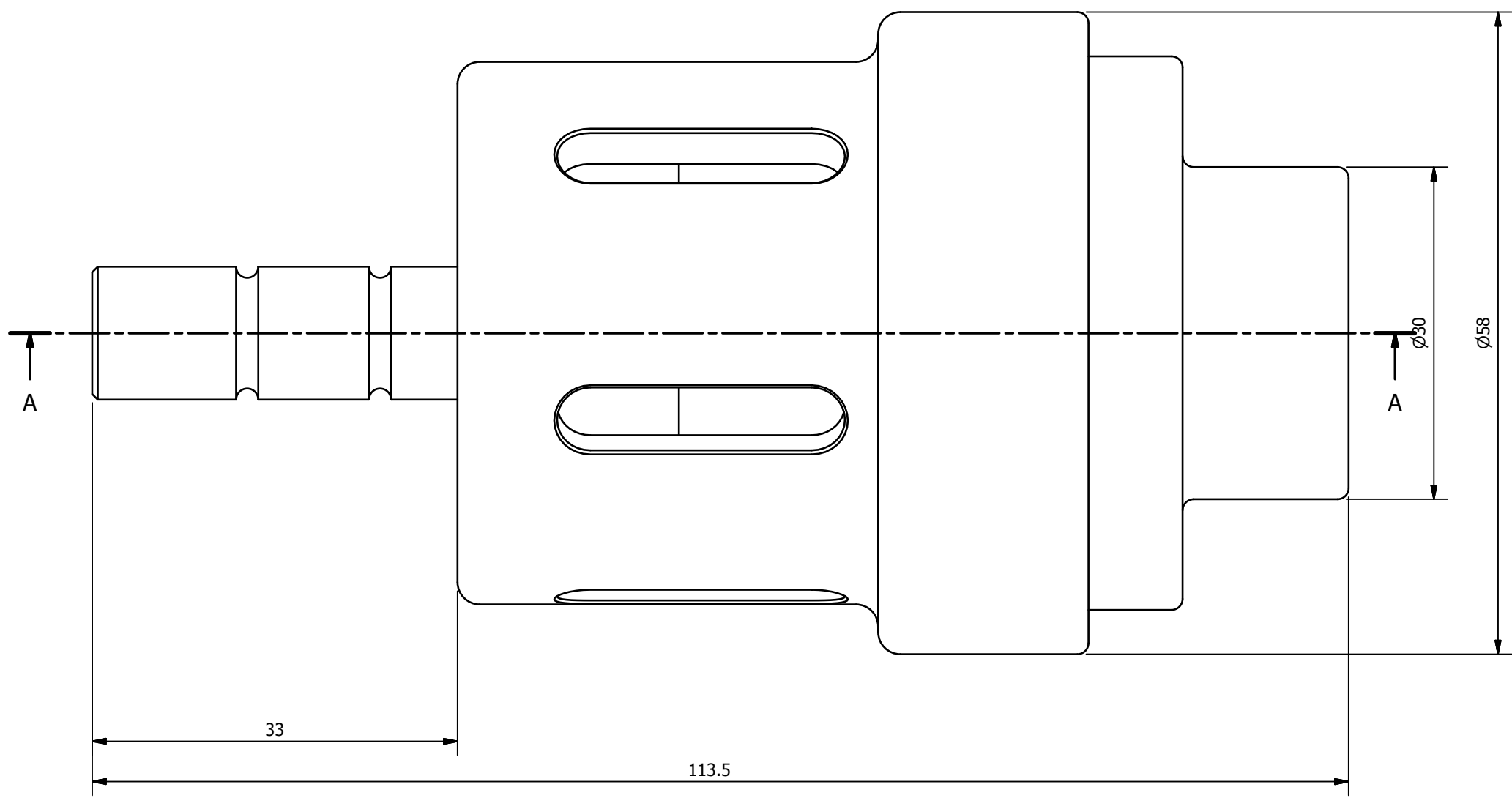
PARTS LIST					
ITEM	QTY	PART NUMBER	MATERIAL	MASS	DESCRIPTION
1	1	6231-153	POM-H (natural / white)	0.01 kg	Piston Shaft
2	1	6231-152	POM-H (black)	0.01 kg	Piston
3	1	6231-150	POM-H (black)	0.05 kg	Housing
4	1	6231-151	POM-H (black)	0.04 kg	Housing
5	1	6231-154	Rubber	0 kg	Bellows
6	1	6231-155	Stainless Spring Steel	0.01 kg	Coil Spring



VIEW1 (2 : 1)



VIEW3 (1 : 1)



01	15.03.2013	For Construction			POD	EN	POD		
REV	DATE	DESCRIPTION			BY	CHKD	APPD		
WEIGHT:									
IN AIR:		0,128 kg							
IN WATER:		0,042 kg							
UNLESS OTHERWISE SPECIFIED:									
ALL DIMENSIONS ARE									
IN MILLIMETRES									
TOLERANCES:									
LINEAR: ISO 2768-1 m									
ANGULAR: ISO 2768-1 m									
EDGES: ISO 2768-1 m									
REMOVE ALL BURRS									
BREAK ALL SHARP EDGES									
FIRST ANGLE		SHEET SIZE: A3		SHEET NO.: 1 OF 1		SCALE:			
PROJECTION		DRAWING NO.: 6231-010		LATEST REV.: 01					

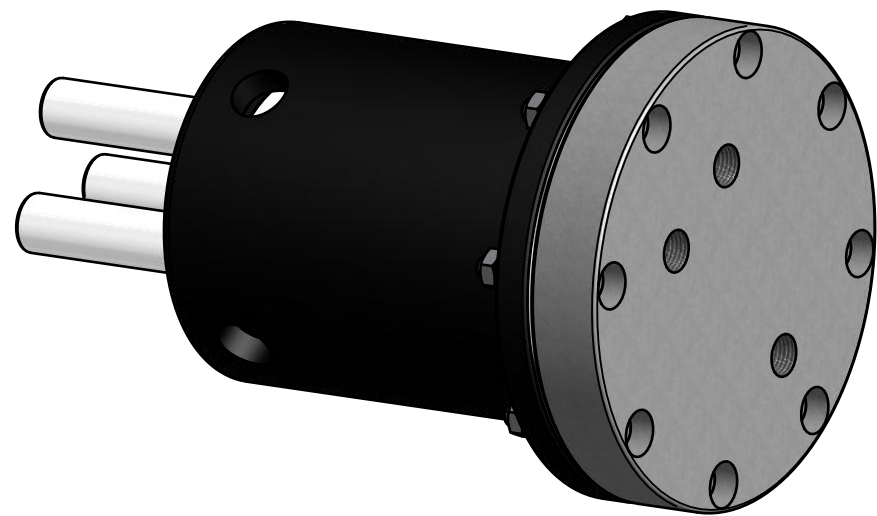
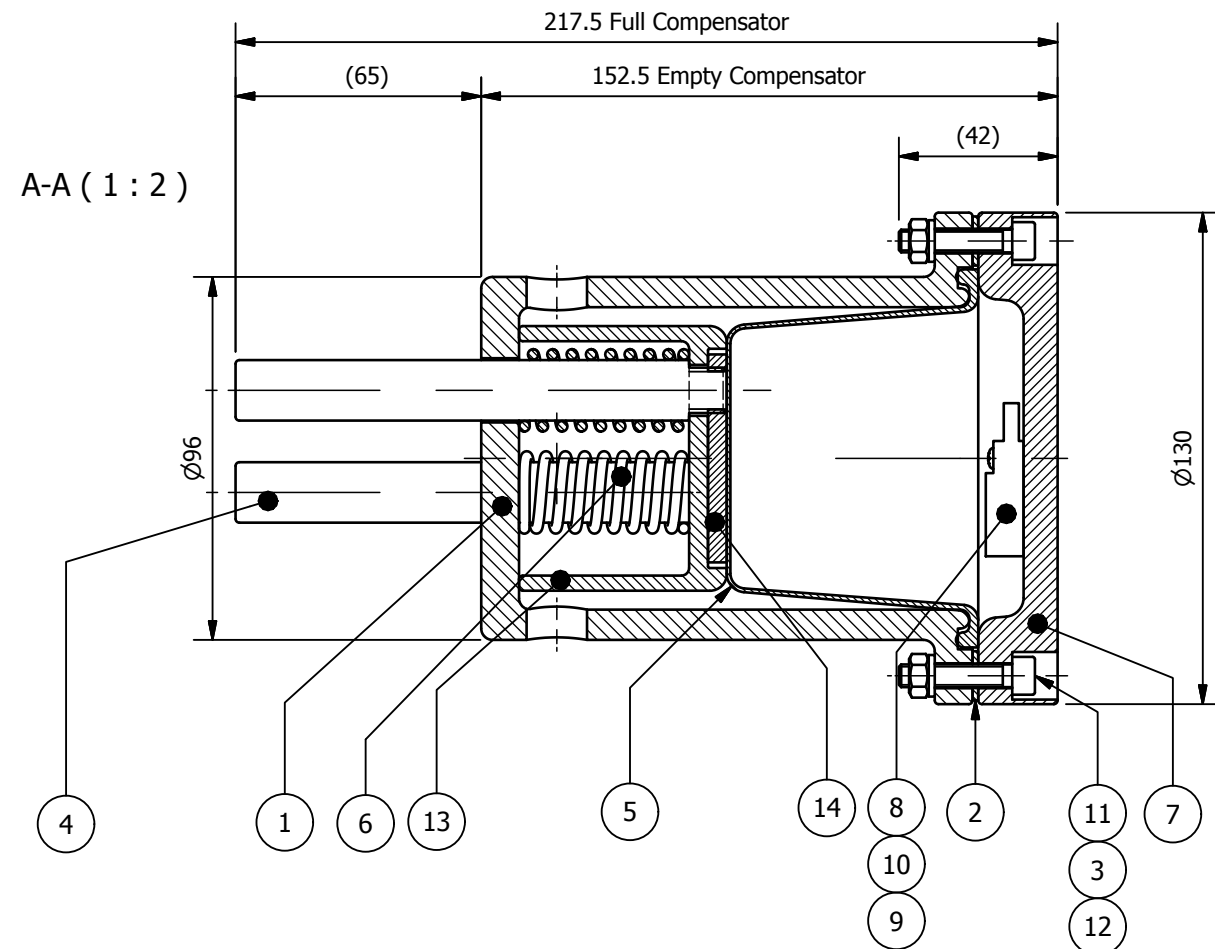
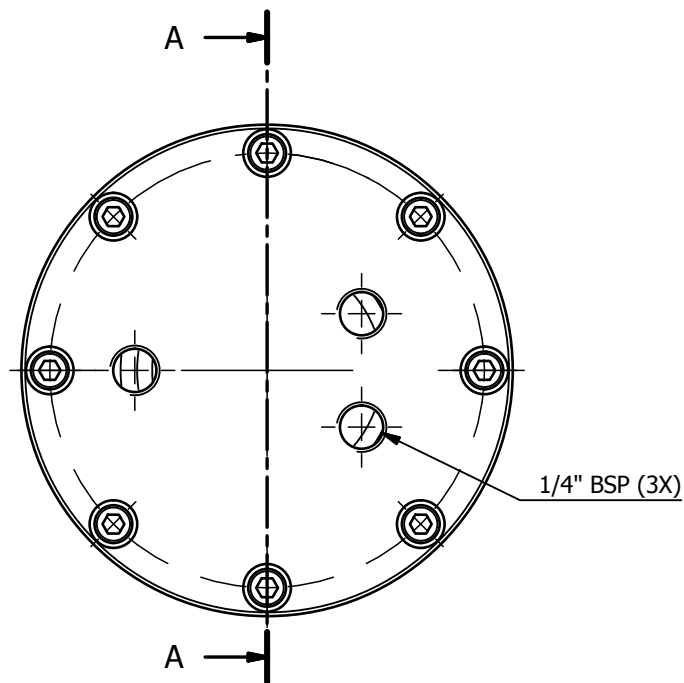


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PROJECT TITLE: P6231
 P6231
 DRAWING TITLE: Mini Compensator - 30 mml



PARTS LIST					
ITEM	QTY	PART NUMBER	MATERIAL	MASS	DESCRIPTION
1	1	6231-101	POM-H	0.53 kg	Housing
2	1	6231-104	Stainless Steel	0.05 kg	Washer
3	8	ISO 7092 - ST 6 - 140 HV	Stainless Steel	0 kg	Washer
4	3	6231-103	POM-H	0.04 kg	Piston guide
5	1	6231-105	Rubber	0.03 kg	Bellows
6	3	6231-106	Spring Steel	0.03 kg	Coil Spring
7	1	6231-120	Stainless Steel	1.56 kg	Cover
8	1	OMRON-TL_W5MC1		0 kg	Sensor
9	2	ISO 7092 - ST 3 - 140 HV	Stainless Steel	0 kg	Washer
10	2	ISO 7045 - M3 x 10 - 4.8 - Z	Stainless Steel	0 kg	Screw
11	8	ISO 4762 - M6 x 30	Stainless Steel	0.01 kg	Screw
12	8	ISO 4032 - M6	Stainless Steel	0 kg	Nut
13	1	6231-121	POM-H	0.08 kg	Piston
14	1	6231-122	Stainless Steel	0.09 kg	Senor Plate

01	2013-01-28	As Built	POD	EN	POD
01	13.04.2012	For construction	POD	EN	POD
REV	DATE	DESCRIPTION	BY	CHKD	APPD
WEIGHT:					
IN AIR:		2,64 kg			
IN WATER:		1,85 kg			
UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN MILLIMETRES					
TOLERANCES: LINEAR: ISO 2768-1 ANGULAR: ISO 2768-1 EDGES: ISO 2768-1					
REMOVE ALL BURRS BREAK ALL SHARP EDGES					
FIRST ANGLE PROJECTION					
SHEET SIZE: A3		SHEET NO.: 1 OF 1	SCALE: 01		
DRAWING NO.: 6231-001		LATEST REV.: 01			

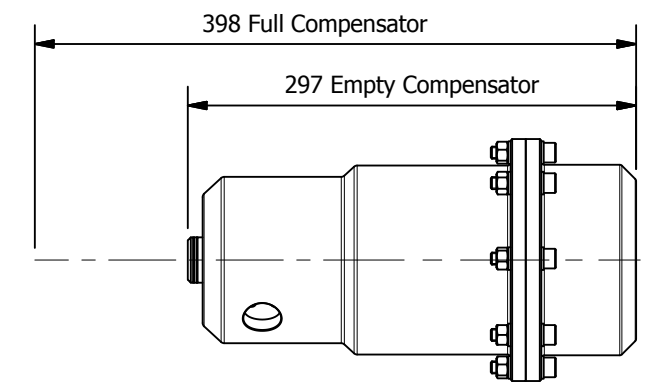
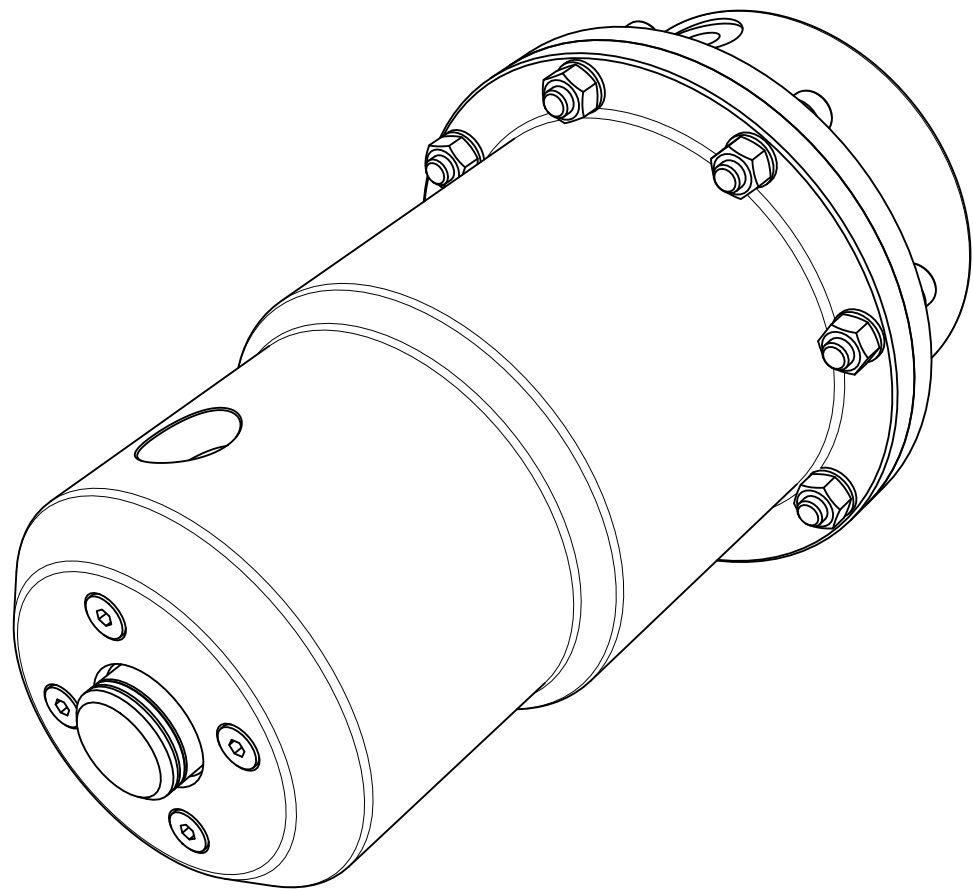
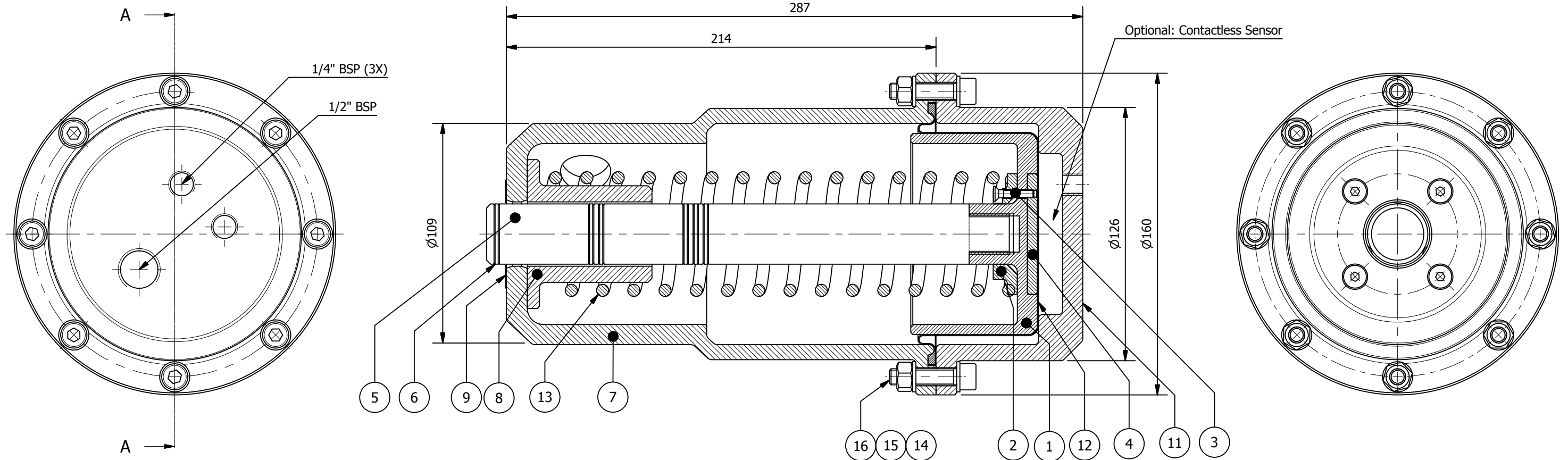
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PROJECT TITLE: P6231
 DRAWING TITLE: Compensator 0.3L - GA

A-A (1:2)



PARTS LIST					
ITEM	QTY	PART NUMBER	MATERIAL	MASS	DESCRIPTION
1	1	6231-130	POM	0.22 kg	Piston
2	1	6231-128	POM	0.02 kg	Guiding
3	3	ISO 10642 - M4 x 20	Stainless Steel	0 kg	Screw
4	1	6231-129	Stainless Steel	0.11 kg	Sensor plate
5	1	6231-126	POM	0.25 kg	Indicator
6	6	ISO 3601-1 - B 0250 G	Rubber	0 kg	O-ring
7	1	6231-134	POM	1.03 kg	House
8	1	6231-127	POM	0.11 kg	Guidance
9	4	ISO 10642 - M6 x 16	Steel	0 kg	Screw
10	1	6231-133	Rubber	0.03 kg	Bellows
11	1	6231-131	Aluminium	1.12 kg	Cover
12	1	6231-132	Rubber	0.02 kg	Bellows
13	1	6231-135	Stainless Steel	0.6 kg	Coil spring
14	16	ISO 7092 - ST 8 - 140 HV	Stainless Steel	0 kg	Washer
15	8	ISO 4034 - M8	Steel, Mild	0.01 kg	Nut
16	8	ISO 4762 - M8 x 35	Stainless Steel	0.02 kg	Screw

02	2013-01-29	As Built	POD	KJG	POD
01	10.10.2012	Fo Construction	POD	KJG	POD
REV	DATE	DESCRIPTION	BY	CHKD	APPD
WEIGHT:					
IN AIR:		3,74 kg			
IN WATER:		2,03 kg			
UNLESS OTHERWISE SPECIFIED:					
ALL DIMENSIONS ARE IN MILLIMETRES					
TOLERANCES:					
LINEAR: ISO 2768-1					
ANGULAR: ISO 2768-1					
EDGES: ISO 2768-1					
REMOVE ALL BURRS					
BREAK ALL SHARP EDGES					
FIRST ANGLE PROJECTION					
SHEET SIZE: A3		SHEET NO.: 1 OF 1		SCALE:	
DRAWING NO.: 6231-008				LATEST REV.: 02	

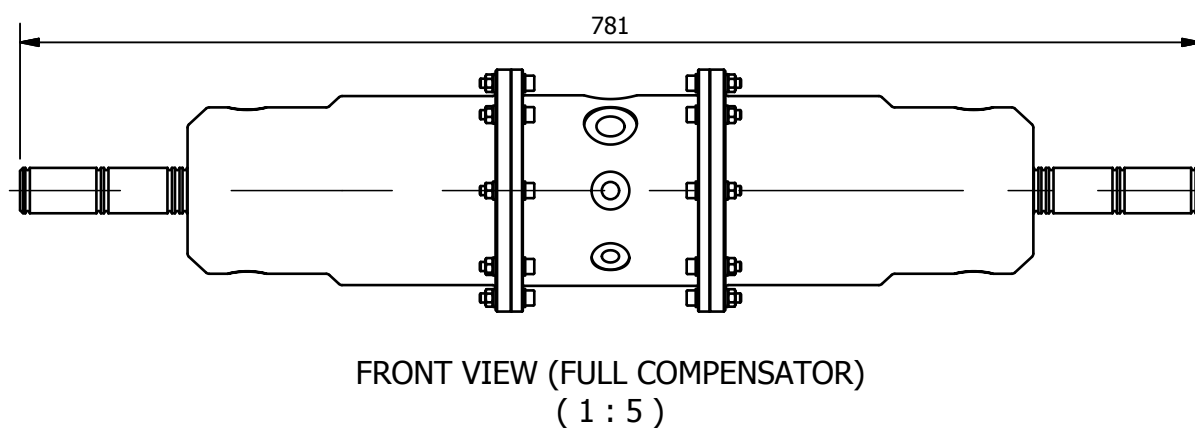
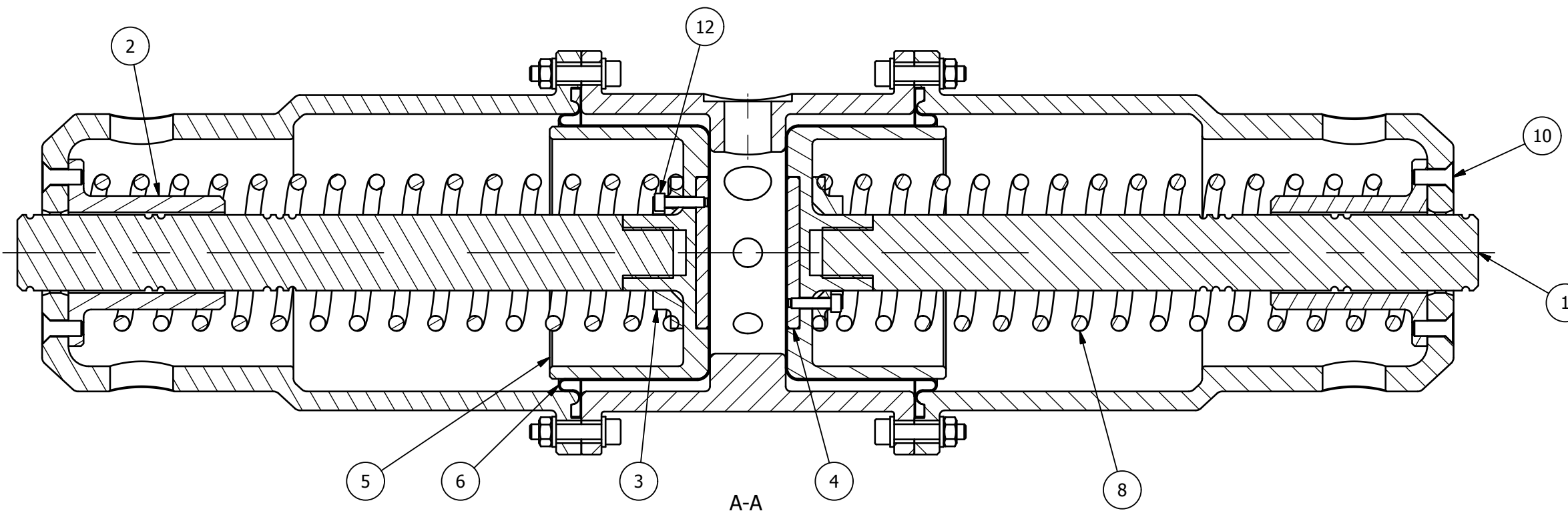
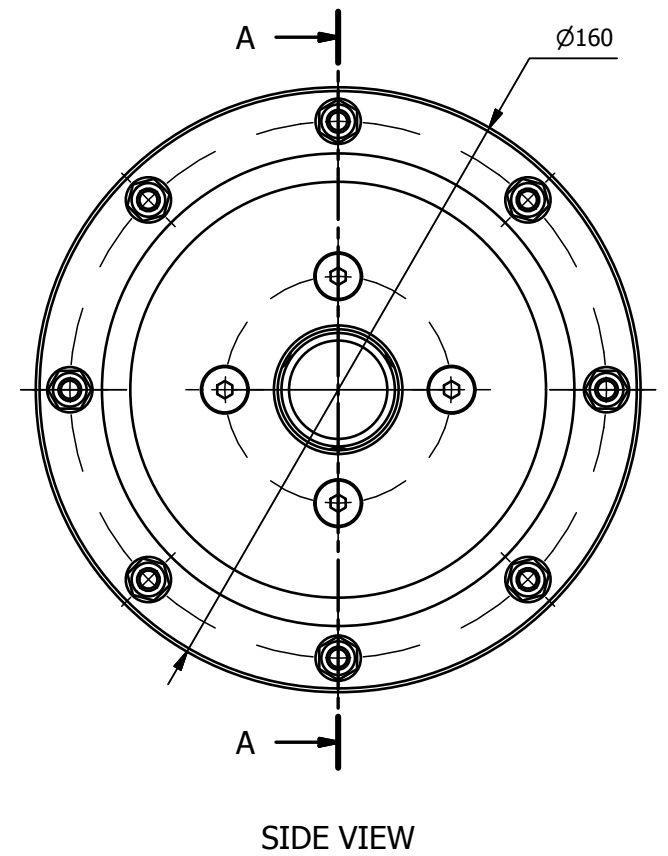
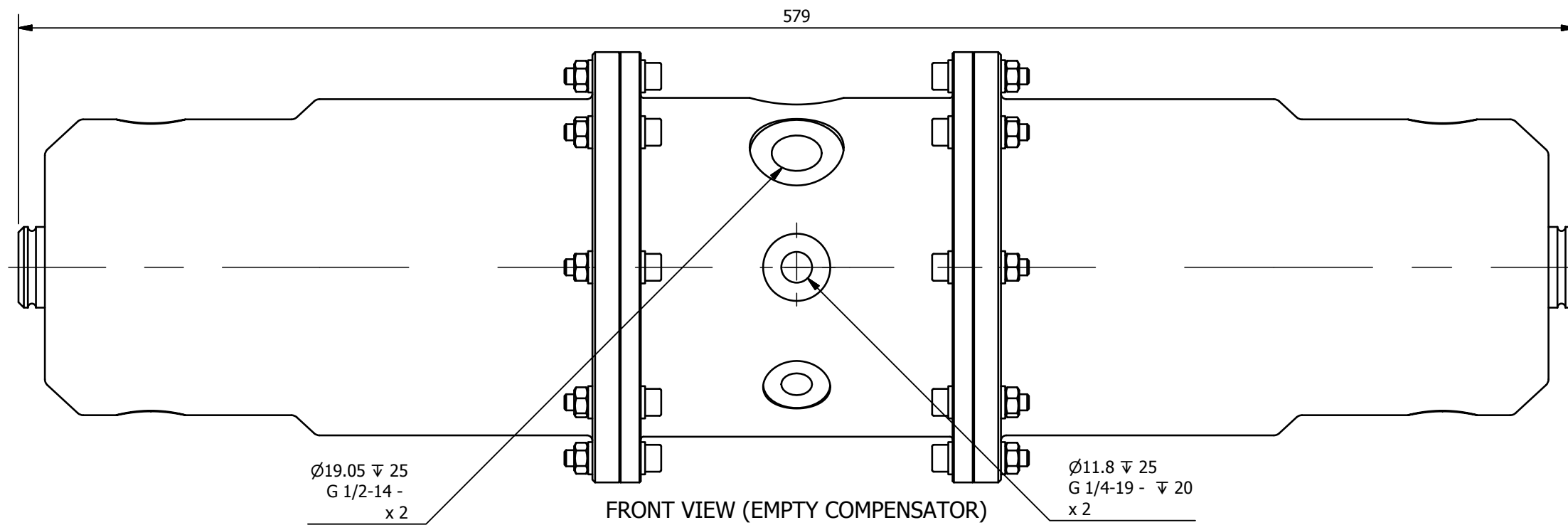


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PROJECT TITLE: P6231
 P6231

DRAWING TITLE: COMPENSATOR 1.0 L - GA



01	02.03.2015	FOR CONSTRUCTION		
REV	DATE	DESCRIPTION		
		JKK	RH	JKK
		BY	CHKD	APPD
WEIGHT:				
IN AIR:	6,62 kg			
IN WATER:	3,48 kg			
SURFACE AREA:	1011 cm ²			
UNLESS OTHERWISE SPECIFIED:				
ALL DIMENSIONS ARE IN MILLIMETRES				
TOLERANCES:				
LINEAR: ISO 2768-1 C				
ANGULAR: ISO 2768-1 C				
EDGES: ISO 2768-1 C				
REMOVE ALL BURRS				
BREAK ALL SHARP EDGES				
FIRST ANGLE PROJECTION				
PROJECT TITLE:		P6231		
DRAWING TITLE:		COMPENSATOR 2,0 L		
SHEET SIZE:	A3	SHEET NO.:	1 OF 2	SCALE:
DRAWING NO.:	6231-003			LATEST REV.:
				01



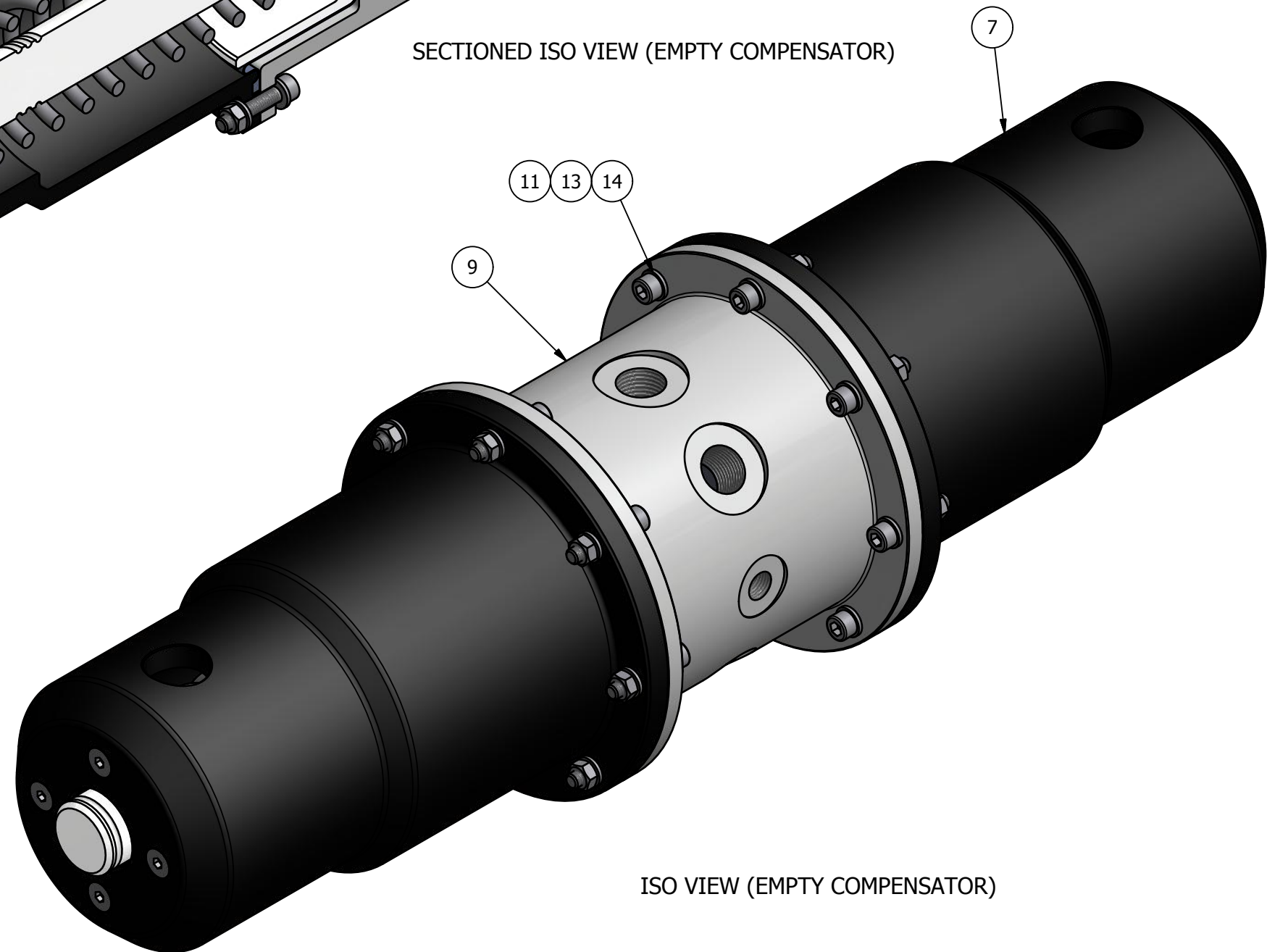
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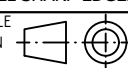


SECTIONED ISO VIEW (EMPTY COMPENSATOR)



ISO VIEW (EMPTY COMPENSATOR)

PARTS LIST						
ITEM	QTY	PART NUMBER	MATERIAL	DESCRIPTION	MASS	REV.
1	2	6231-126	POM-H (natural / white)	Indicator	0.25 kg	01
2	2	6231-127	POM-H (black)	Guidance	0.09 kg	02
3	2	6231-128	POM-H (natural / white)	Guiding	0.02 kg	02
4	2	6231-129	Stainless Steel, S165M	Sensor plate	0.11 kg	01
5	2	6231-130	POM-C (natural / white)	Piston	0.22 kg	01
6	2	6231-132	AS SUPPLIED	DIAPHRAGM BFA 110/100-65 50NBR/253	0.02 kg	01
7	2	6231-134	POM-H (black)	House	1.03 kg	01
8	2	6231-135	Stainless Spring Steel, EN 10270-3-1.4310	Coil spring	0.6 kg	01
9	1	6231-201	Aluminium, 6082-T6	HOUSING	1.67 kg	01
10	8	DIN 7991 - M6x16	Stainless Steel	Hexagon socket countersunk head cap screws	0 kg	
11	16	ISO 4032 - M6	Stainless Steel	Hexagon nuts, style 1 - Product grades A and B	0 kg	
12	6	ISO 4762 - M4 x 16	Stainless Steel	Hexagon Socket Head Cap Screw	0 kg	
13	16	ISO 4762 - M6 x 30	Stainless Steel	Hexagon Socket Head Cap Screw	0.01 kg	
14	32	ISO 7089 - 6 - 140 HV	Stainless Steel	Plain washers - Normal series - Product grade A	0 kg	

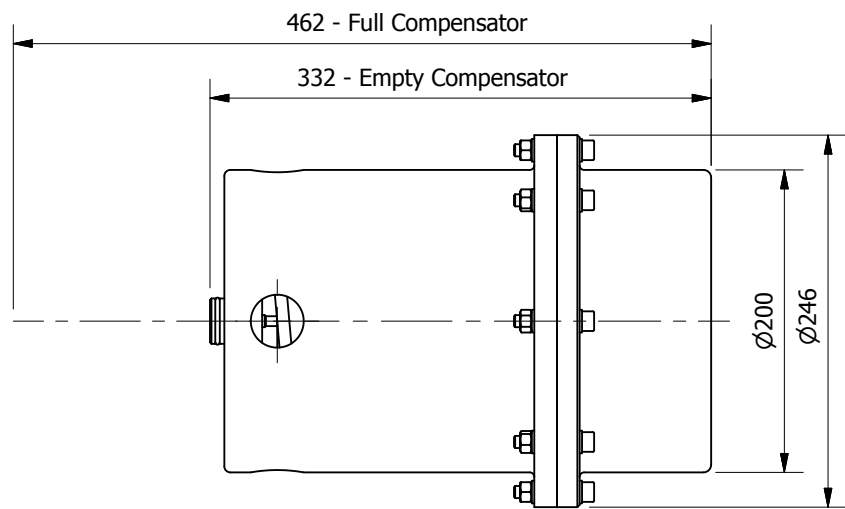
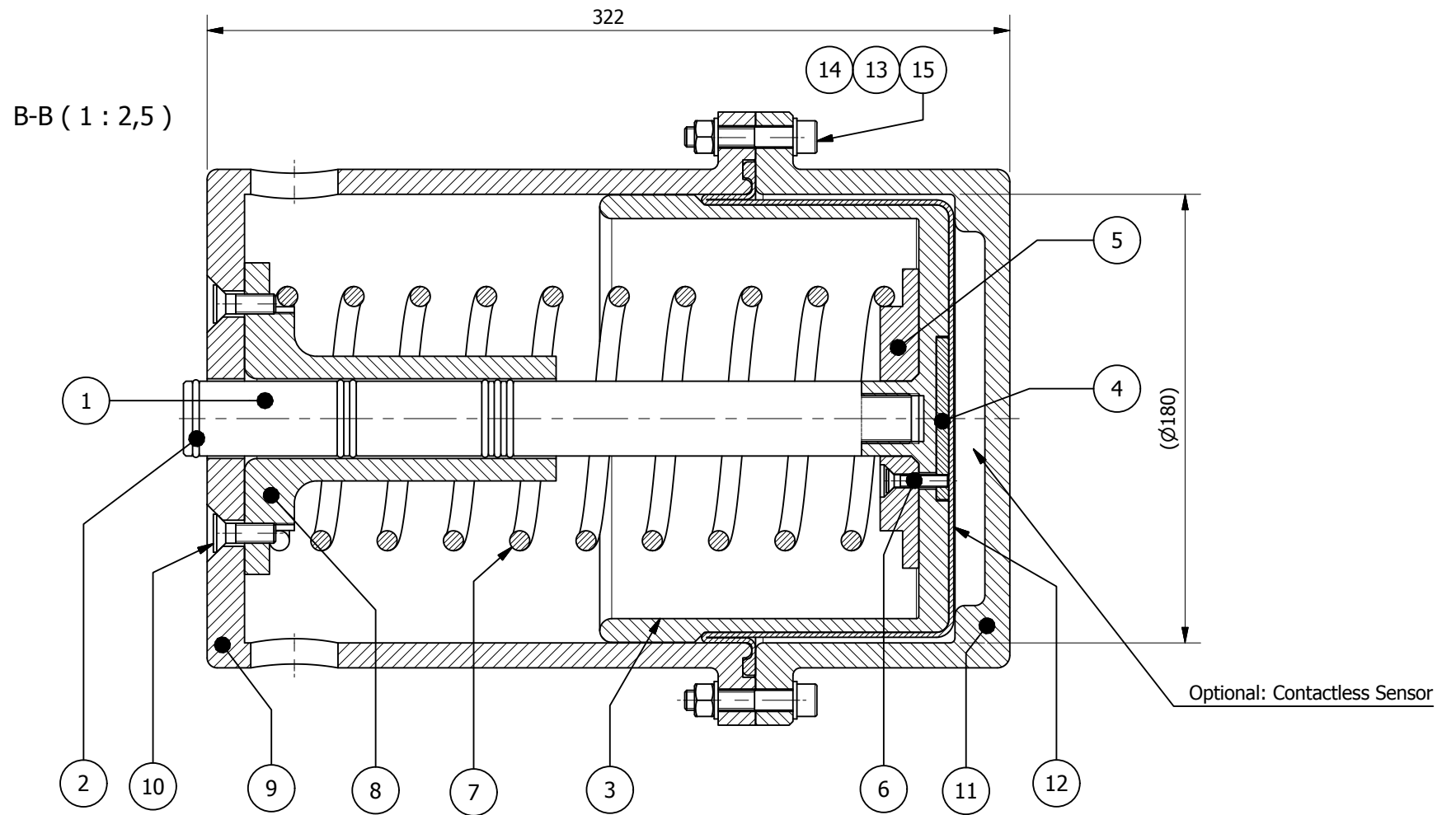
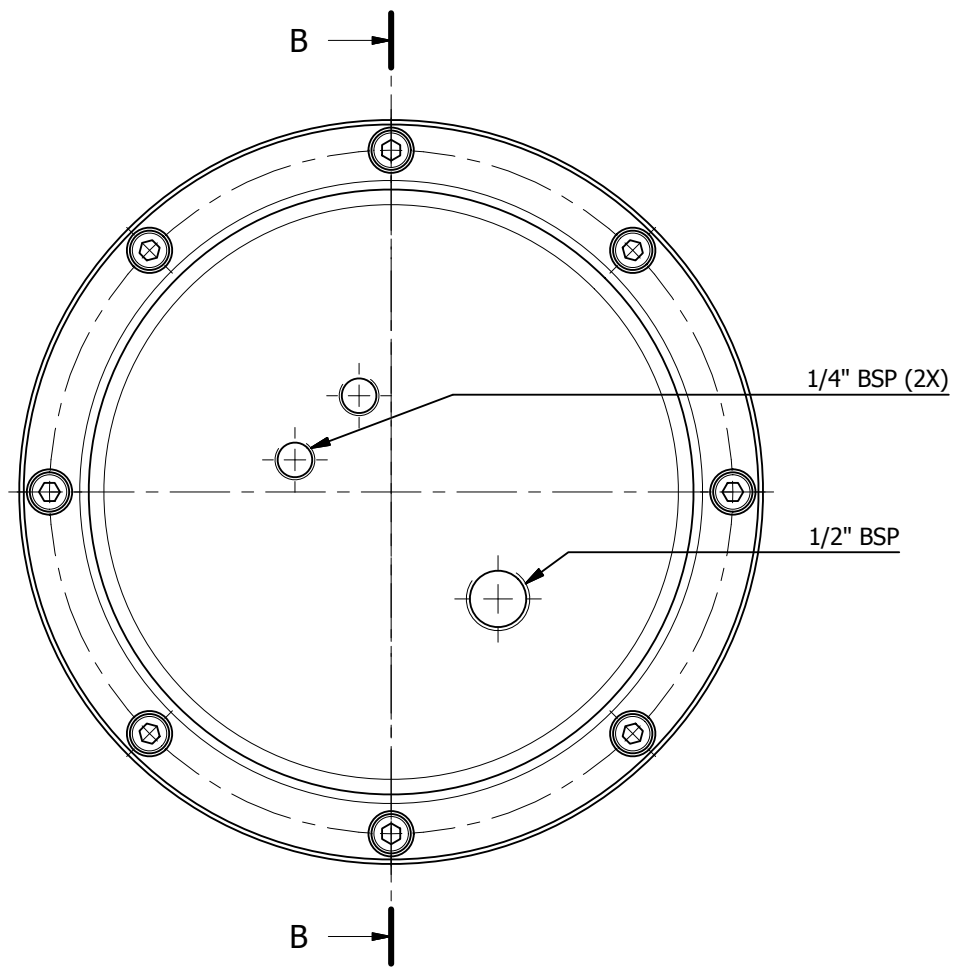
01	02.03.2015	FOR CONSTRUCTION			JKK	RH	JKK
REV	DATE	DESCRIPTION			BY	CHKD	APPD
WEIGHT: IN AIR:	6,62 kg	 IKM TECHNIQUE AS Tomeroseveien 12, 4315 SANDNES Tel.: 51 80 05 20 E-mail: ikmtechnique@IKM.no Web: www.IKM.no					
IN WATER:	3,48 kg						
SURFACE AREA:	1011 cm ²						
UNLESS OTHERWISE SPECIFIED:							
ALL DIMENSIONS ARE IN MILLIMETRES							
TOLERANCES:							
LINEAR: ISO 2768-1 C							
ANGULAR: ISO 2768-1 C							
EDGES: ISO 2768-1 C							
REMOVE ALL BURRS							
BREAK ALL SHARP EDGES							
FIRST ANGLE PROJECTION				SHEET SIZE: A3		SHEET NO.: 2 OF 2	
				DRAWING NO.: 6231-003		SCALE: 1:2	
						LATEST REV.: 01	



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PROJECT TITLE: P6231

DRAWING TITLE: COMPENSATOR 2,0 L



PARTS LIST					
ITEM	QTY	PART NUMBER	MATERIAL	MASS	DESCRIPTION
1	1	6231-137	POM-C (natural / white)	0.28 kg	Indicator
2	6	ISO 3601-1 - B 0258 G	Rubber	0 kg	O-ring
3	1	6231-109	POM-C (black)	1.01 kg	Guiding Tube
4	1	6231-125	Stainless Steel, S165M	0.13 kg	Sensor plate
5	1	6231-107	POM-C (natural / white)	0.17 kg	Guide
6	3	ISO 10642 - M5 x 25	Stainless	0 kg	Screw
7	1	6231-112	Stainless Spring Steel, EN 10270-3-1.4310	1.23 kg	Coil Spring
8	1	6231-108	POM-C (black)	0.41 kg	Guiding Tube
9	1	6231-111	POM-C (black)	2.51 kg	Bottle 3L
10	4	ISO 10642 - M8 x 25	Stainless	0.01 kg	Screw
11	1	6231-123	Aluminium, 6082-T6	3.19 kg	Cover
12	1	6231-115	Rubber	0.19 kg	Bellow Art. no: 3844024
13	16	ISO 7092 - ST 8 - 140 HV	Stainless Steel	0 kg	Washer
14	8	ISO 4034 - M8	Stainless	0.01 kg	Nut
15	8	ISO 4762 - M8 x 45	Stainless Steel, 440C	0.02 kg	Screw

01	2013-01-25	As Built	POD	EN	POD
REV	DATE	DESCRIPTION	BY	CHKD	APPD
WEIGHT:					
IN AIR:		9,44 kg			
IN WATER:		4,74 kg			
UNLESS OTHERWISE SPECIFIED:					
ALL DIMENSIONS ARE IN MILLIMETRES					
TOLERANCES:					
LINEAR: ISO 2768-1 m					
ANGULAR: ISO 2768-1 m					
EDGES: ISO 2768-1 m					
REMOVE ALL BURRS BREAK ALL SHARP EDGES					
FIRST ANGLE PROJECTION					
SHEET SIZE: A3		SHEET NO.: 1 OF 1		SCALE:	
DRAWING NO.: 6231-000		LATEST REV.: 01			

IKM TECHNIQUE AS

Tomroseveien 12, 4315 SANDNES

Tel.: 51 80 05 20

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PROJECT TITLE: **P6231**

DRAWING TITLE: **COMPENSATOR 3.0 L - GA**