USER MANUAL FOR SUBSEA COMPENSATORS 0,03-3 LITER

Document title	:	*UMA-6231-XXX Subsea Compensators*
IKM Subsea AS ref.	:	*P6231* / IKM-1003730
Customer ref.	:	*Not applicable*

IKM Subsea 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
03	15.11.24	Update + Added IKM-1003730	TO	OG	AL

1 GENERAL INFORMATION

The purpose of this manual is to guide and safeguard users of IKM Subsea range of compensators. Models covered by this manual are 0.03 liter, 0,25 liter, 1.0 liter, 2.0 liter and 3.0 liter types. Please note that all IKM Subsea compensators are designed, tested and used for compensation of oil filled 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 oil filled 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.

1.1 Abbreviations

HPU	Hydraulic Power Unit
ROV	Remotely Operated Vehicle
kg	Kilogram
mm	Millimeter
BSP	British standard pipe
JIC	Joint industry council
CCM	Cubic centimeter
LPM	Liter per minute
Nm	Newton meter
CCW	Counterclockwise
ml	Milliliter

1.2 References

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

2 TECHNICAL SPECIFICATION

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 to enable bleeding the compensator for air. The 2L model must however be installed horizontally for better air-bleeding.

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
0,25 liter	IKM-1003730	Ø 130 mm Max length 207 mm Min length 152 mm	In air: 2 kg In water: 1,22 kg	Mineral oil	10%: 0,08 bar 90%: 0,23 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

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 pipework 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.

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.

4 INSTALLATION

- The compensators shall in general be mounted vertical to allow for bleeding out air.
- The 2L compensator must be mounted horizontally with designated bleed-port up.
- Make sure to have enough free space around the compensator so the indicator shaft can move freely.
- Fill up the compensator ¼ to ¾ full and bleed all air out of the compensator and circuit to be compensated. Start bleeding process at the compensator itself and continue to next logic bleed point of the circuit.
- The filling-level in the compensator during operations/use 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 setting a fluid level.

5 MAINTENANCE

Dismantling of compensators

30 ml type, ref GA dwg 6231-010

1. Not serviceable. Replace unit if failure.

0.25 liter type, ref GA dwg IKM-1003730

1. Make sure all internal pressure is released from compensator
2. Loosen 8pc cylinder head cap screws (pos. 6).
3. Make sure the spring pressure is low and stable.
4. Unscrew 8pc cylinder head cap screws (pos. 6).
5. Retract bellow (pos. 7) and piston rod (pos. 4) from bottle (pos. 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. 8.Install new bellow if needed and mount together compensator in the opposite order as described above.

Note: Be aware of oil spill, use necessary protective equipment.

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)
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

Note: Be aware of oil spill, use necessary protective equipment.

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

Note: Be aware of oil spill, use necessary protective equipment.

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.

6 SPARE PART LIST

- Spring
- Bellow
- Sensor/Cable if applicable
- Nuts and bolts

7 REVISION CHANGES

Revision	Procedure change	Author
01	*Original version*	JHR
02	*Update*	KF
03	*Update*	TO

8 CONTACT INFORMATION

All enquiries relating to the equipment should be addressed to:

IKM Subsea AS
Nordlysveien 7,
N-4340 Bryne
Norway

Phone, 24/7 : +47 962 00 210 / Or IKM Subsea's Sales representative

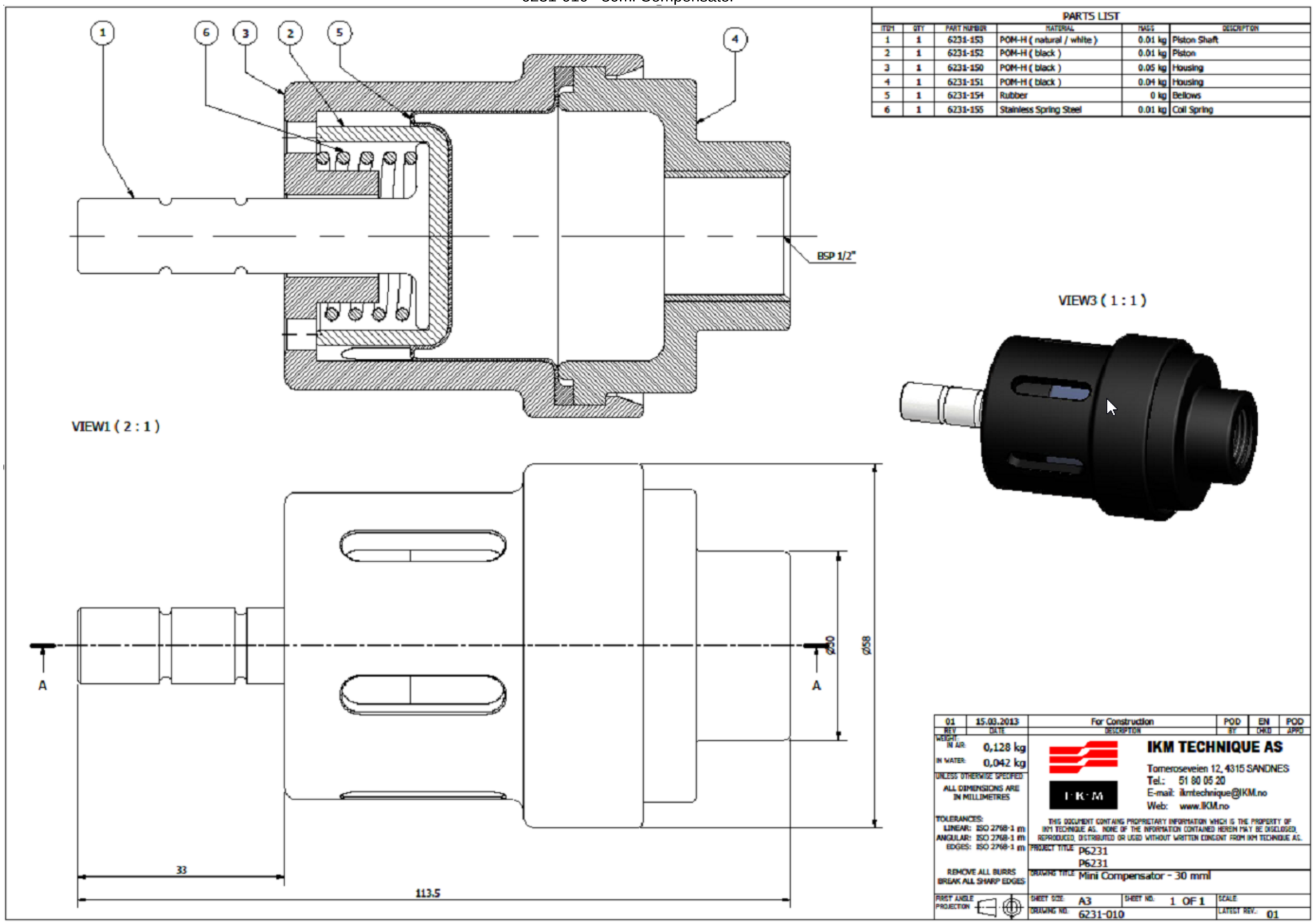
Mail : Subseatools@ikm.no / Or IKM Subsea's Sales representative

9 APPENDIX

	Doc number	Description	Rev
Appendix A	*6231-XXX*	*Drawings of Compensators*	
Appendix B			

Appendix A

6231-010 30ml Compensator



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

VIEW3 (1 : 1)

REV	DATE	DESCRIPTION	BY	CHKD	APPD
01	15.03.2013	For Construction	POD	EN	POD

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 PROJECTION

IKM TECHNIQUE AS
Tomeroseveien 12, 4315 SANDNES
Tel.: 51 80 05 20
E-mail: ikmtechnique@IKM.no
Web: www.IKM.no

PROJECT TITLE: P6231
P6231

DRAWING TITLE: Mini Compensator - 30 mml

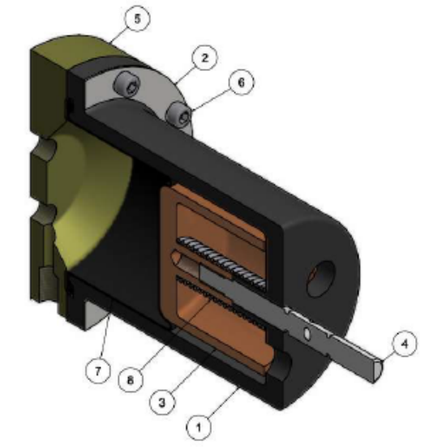
SHEET SIZE: A3 | SHEET NO. 1 OF 1 | SCALE

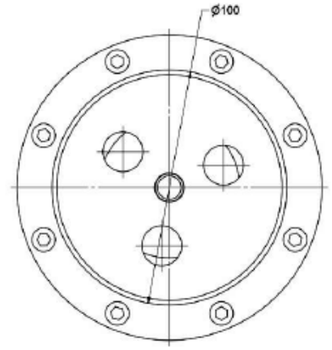
DRAWING NO.: 6231-010 | LATEST REV.: 01

IKM-1003730 0,25 liter Compensator

PART LIST *TITLE COLUMN CONTAINS INFO OF WHAT TYPE OF BOLT, BEAM ETC.

POS	QTY	TITLE*	IKM PART NUMBER	MATERIAL	TOT. MASS	TOT. VOLUME	COMMENTS
1	1	COMPENSATOR BOTTLE 0,25L	IKM-1003724	POM-C (Polyoksymetylen)	0,537 kg	0,381 l	
2	1	COMPENSATOR I WASHER 0,25L	IKM-1003725	SS AISI 316L	0,042 kg	0,005 l	
3	1	COMPENSATOR PISTON 0,25L	IKM-1003726	POM-C (Polyoksymetylen)	0,137 kg	0,097 l	
4	1	COMPENSATOR PISTON ROD 0,25L	IKM-1003727	POM-C (Polyoksymetylen)	0,015 kg	0,011 l	
5	1	COMPENSATOR TOP COVER 0,25L	IKM-1003728	Titanium	1,1 kg	0,244 l	
6	8	CYLINDER HEAD CAP SCREW - DIN 912 - M6 x 25	IKM-7000501	A4	0,071 kg	0,009 l	
7	1	COMPENSATOR BELLOW 0,25L	IKM-1003723	NBR SHORE 70 A	0,063 kg	0,023 l	
8	1	ROV COMPENSATOR SYSTEM 0,25L Compress Spring	IKM-1003733	Stainless Steel	0,031 kg	0,004 l	LESJØFORS





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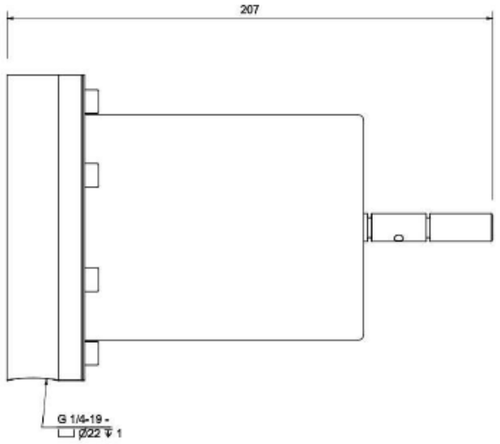
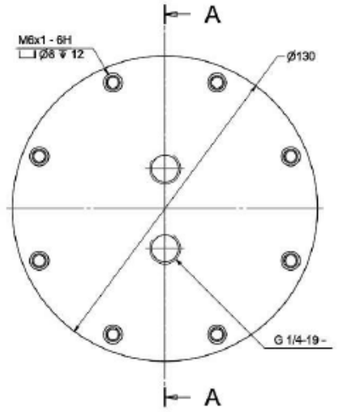
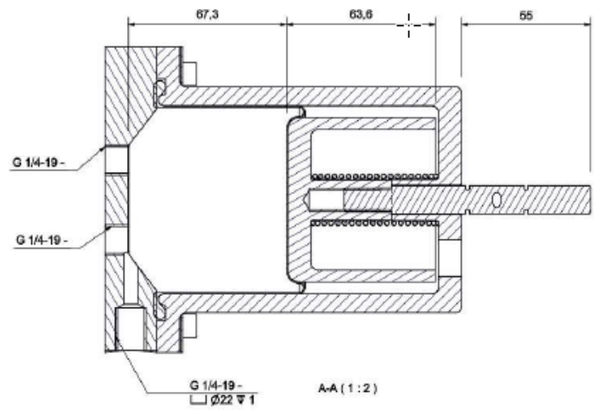


VIEW1 (1 : 2)



VIEW3 (1 : 2)



A-A (1 : 2)

Notes Mechanical Drawing:

1. Fabrication and tolerances shall be according to NS-ISO 2768-1 Medium unless noted otherwise.
2. Max. surface finish Ra=1,6 µm UNO.
3. All sharp edges to be deburred UNO.
4. Dimentions shown is prior to surface treatment.
5. 100% traceability of materials is required in accordance to Materials Certificate 3.1.
6. Surface treatment: NA.

REVISION HISTORY \ APPROVED BY					
REV.	DATE	REVISION DESCRIPTION	Drw	Eng.	Proj.
01	06.05.09	ISSUED FOR CONSTRUCTION	BAN	AL	BLH
02	12.11.09	RENAMED TO 6710-000	BLH	LKA	AL
03	02.05.11	RENAMED TO IKM STD. PART	BAN	AV	TGA
04	12.04.13	IKM-1003729 removed	SEL	AV	SKH

REFRENCE DRAWING	
DOK. NO.	DESCRIPTION
	ROV

IKM Subsea AS

www.ikm.no

ISO-SERTIFIED: ISO 9001:2008

ACHIEVED IT: 2010

TOTAL NUMBER: N/A

PROJECT: STANDARD PARTS

TOLERANCE IF NOT SPECIFIED: NS ISO 2768-1 Medium

PROJ. TYPE E

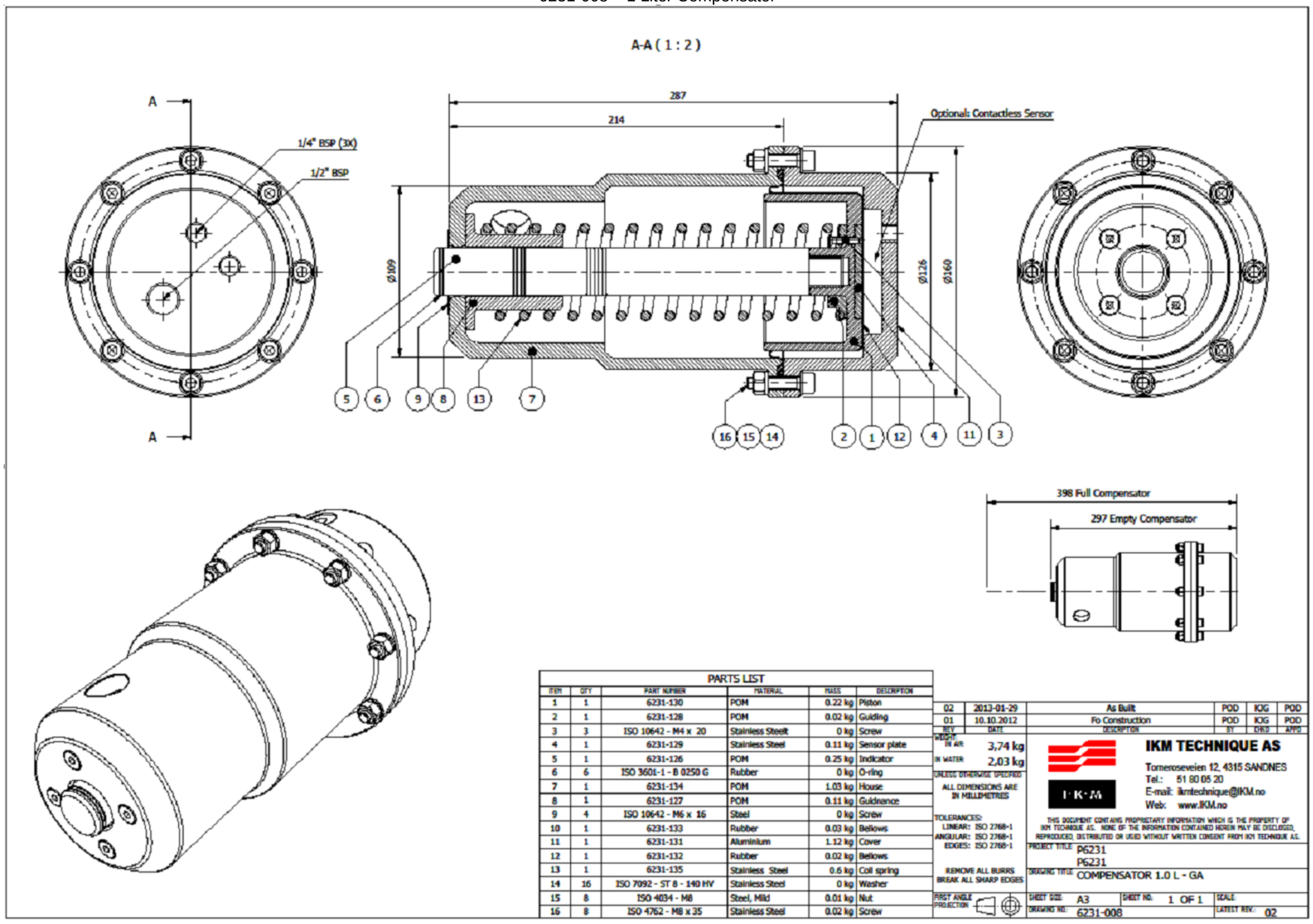
TITLE: ROV COMPENSATOR SYSTEM 0,25L
COMPENSATOR BOTTLE 0,25 L
ASSEMBLY

SIZE	SCALE	PROJECT No.	DOC. No.	REV.	SHEET No.
A3	1:2	STD	IKM-1003730	04	1 OF 1

Autodesk Inventor

06.05.09 C:_Workspace\Designs_IKM STD\Compensators\COM-025L-01\IKM-1003730.dwg

6231-008 1 Liter Compensator



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 Steelt	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	Guidnance
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

REV	DATE	DESCRIPTION	BY	CHKD	APPD
02	2013-01-29	As Built	POD	KJG	POD
01	10.10.2012	Fo Construction	POD	KJG	POD

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

IKM TECHNIQUE AS
Tomeroseveien 12, 4315 SANDNES
Tel.: 51 80 05 20
E-mail: ikmtechnique@IKM.no
Web: www.IKM.no

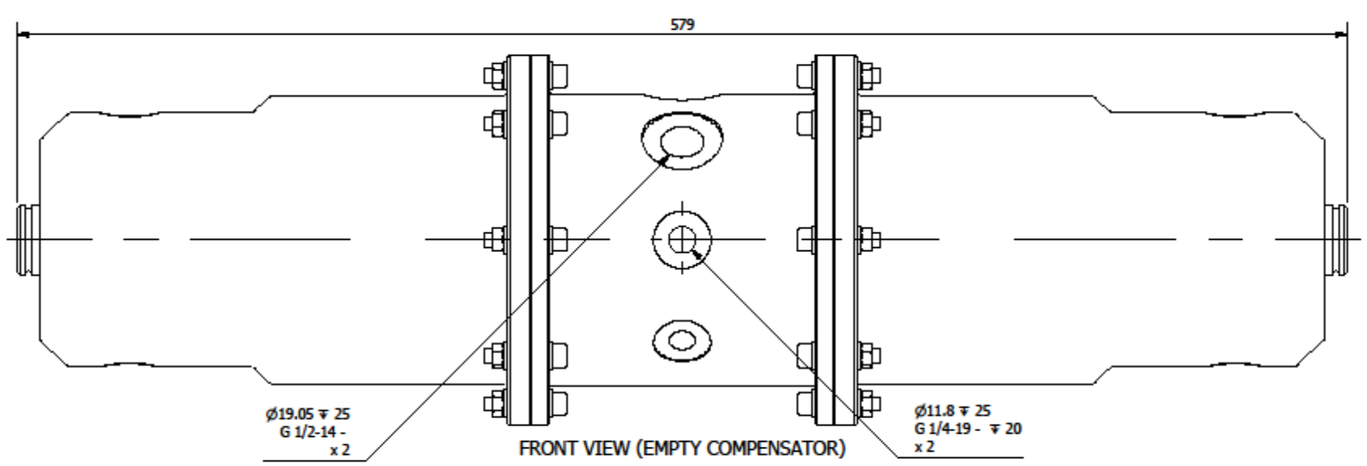
PROJECT TITLE: P6231 P6231

DRAWING TITLE: COMPENSATOR 1.0 L - GA

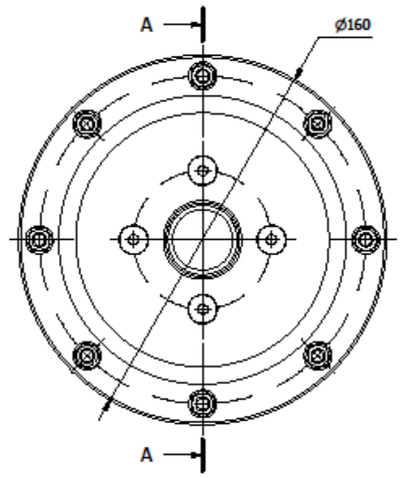
SHEET SIZE: A3 SHEET NO.: 1 OF 1 SCALE:

DRAWING NO.: 6231-008 LATEST REV.: 02

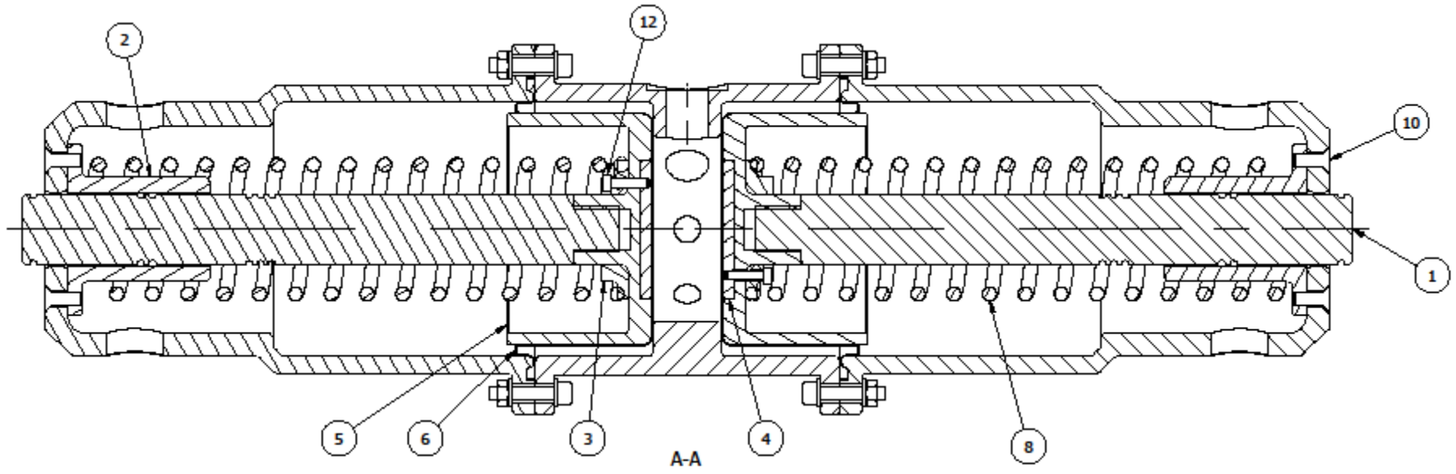
6231-003 2 Liter Compensator (1)



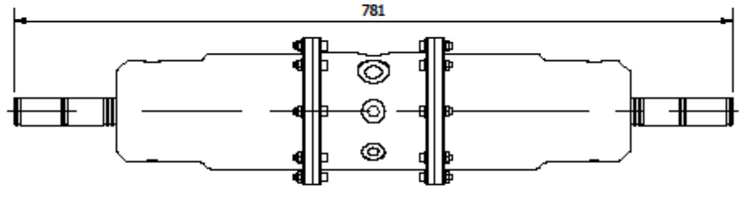
FRONT VIEW (EMPTY COMPENSATOR)



SIDE VIEW



A-A



FRONT VIEW (FULL COMPENSATOR)
(1 : 5)

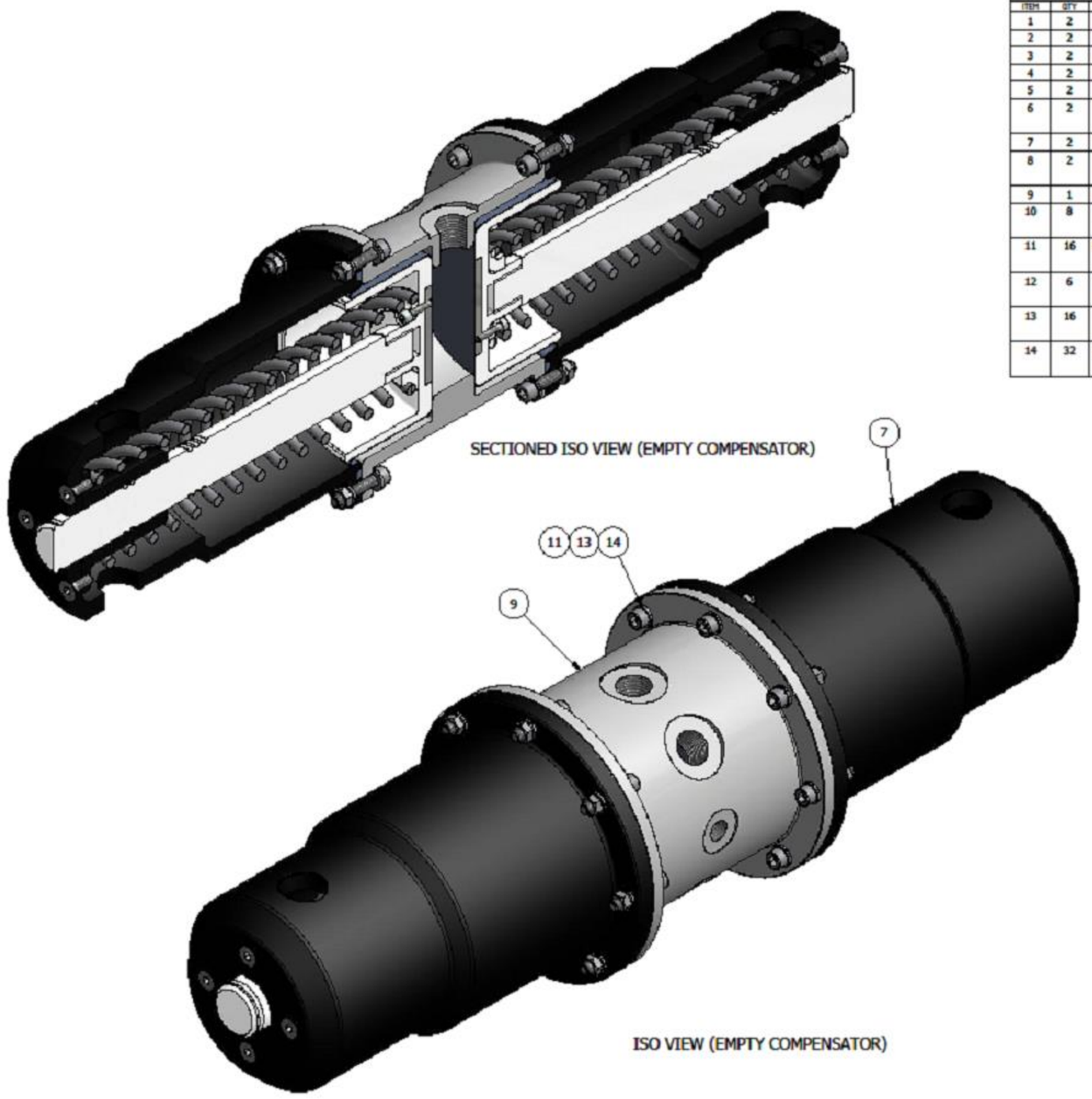
REV	DATE	DESCRIPTION	BY	CHKD	APPD
01	02.03.2015	FOR CONSTRUCTION	JKK	RH	JKK

WEIGHT IN AIR: 6,62 kg
IN WATER: 3,48 kg
SURFACE AREA: 1011 cm²
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

IKM TECHNIQUE AS
Torneroseveien 12, 4315 SANDNES
Tel.: 51 60 05 20
E-mail: ikmtechnique@IKM.no
Web: www.IKM.no

PROJECT TITLE: P6231
DRAWING TITLE: COMPENSATOR 2,0 L
SHEET SIZE: A3 | SHEET NO.: 1 OF 2 | SCALE: 1:2
DRAWING NO.: 6231-003 | LATEST REV.: 01

6231-003 2 Liter Compensator (2)



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)	Guidnance	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 SONBR/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	

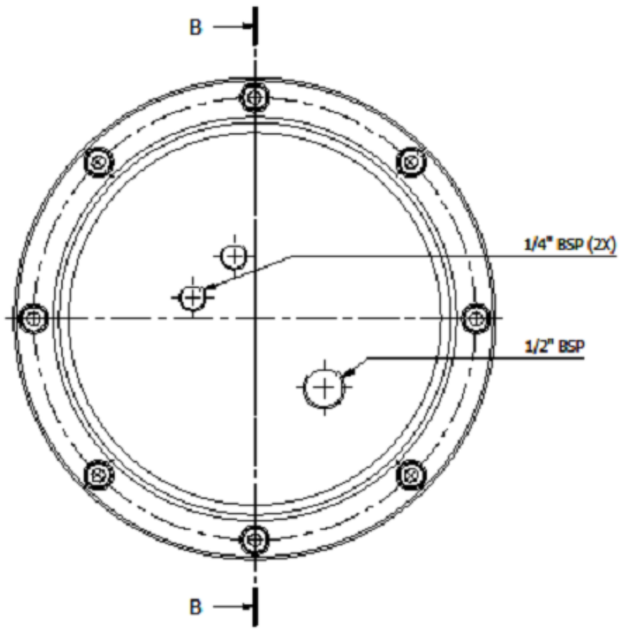
REV	DATE	DESCRIPTION	BY	CHKD	APPD
01	02.03.2015	FOR CONSTRUCTION	JKK	RH	JKK

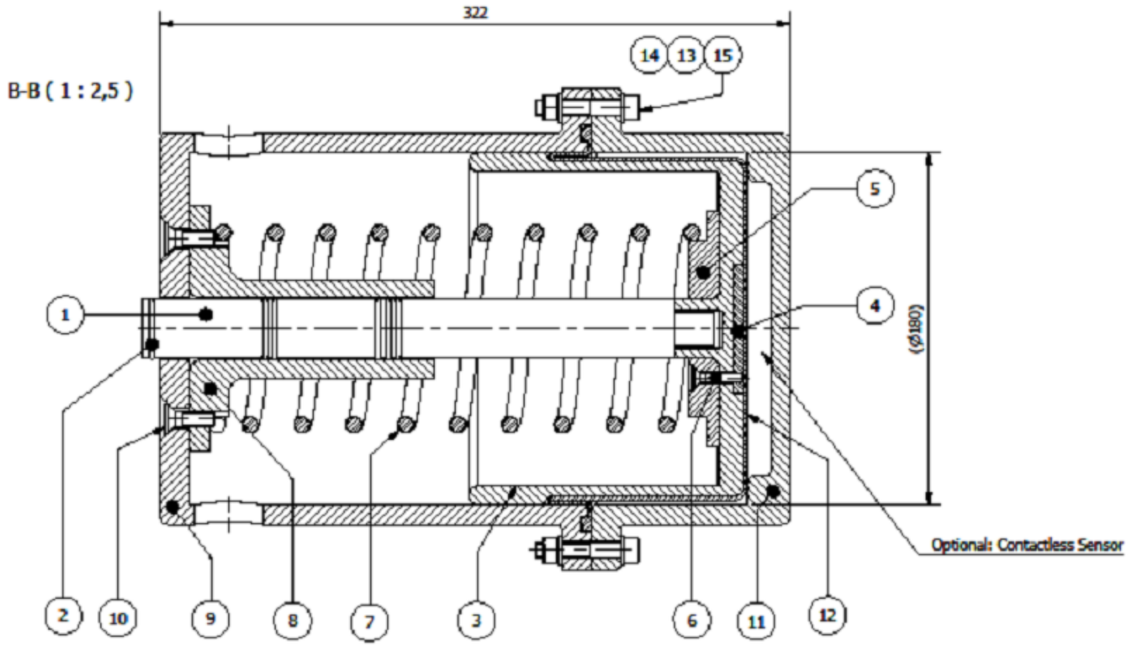
WEIGHT IN AIR: 6,62 kg
IN WATER: 3,48 kg
SURFACE AREA: 1011 cm²
UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN MILLIMETRES
TOLERANCES: LINEAR: ISO 2768-1 C; ANGULAR: ISO 2768-1 C; EDGES: ISO 2768-1 C
REMOVE ALL BURRS BREAK ALL SHARP EDGES
FIRST ANGLE PROJECTION

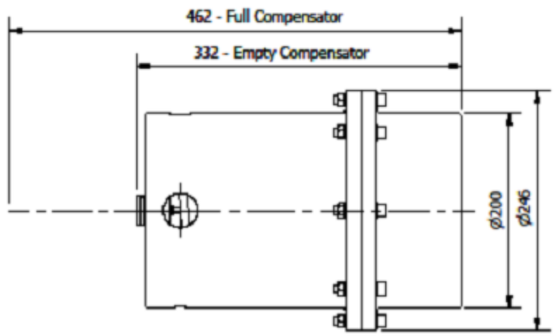
IKM TECHNIQUE AS
Tomeroseveien 12, 4315 SANDNES
Tel.: 51 80 05 20
E-mail: ikmtechnique@IKM.no
Web: www.IKM.no

PROJECT TITLE: P6231
DRAWING TITLE: COMPENSATOR 2,0 L
SHEET SIZE: A3 | SHEET NO.: 2 OF 2 | SCALE: 1:2
DRAWING NO.: 6231-003 | LATEST REV.: 01

6231-000 3 Liter Compensator







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

REV	DATE	DESCRIPTION	BY	CHKD	APPD
01	2013-01-25	As Built	POD	EN	POD

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

IKM TECHNIQUE AS
Torneroseveien 12, 4315 SANDNES
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PROJECT TITLE: P6231
P6231

DRAWING TITLE: COMPENSATOR 3.0 L - GA

SHEET SIZE: A3 SHEET NO. 1 OF 1 SCALE:

DRAWING NO.: 6231-000 LATEST REV.: 01

Appendix A