

OPERATION AND MAINTENANCE MANUAL

Model: M501
 Equipment S/N: M50100718 / M50100818
 Document Date / Rev.: 4 ARPIL 2018 / 03

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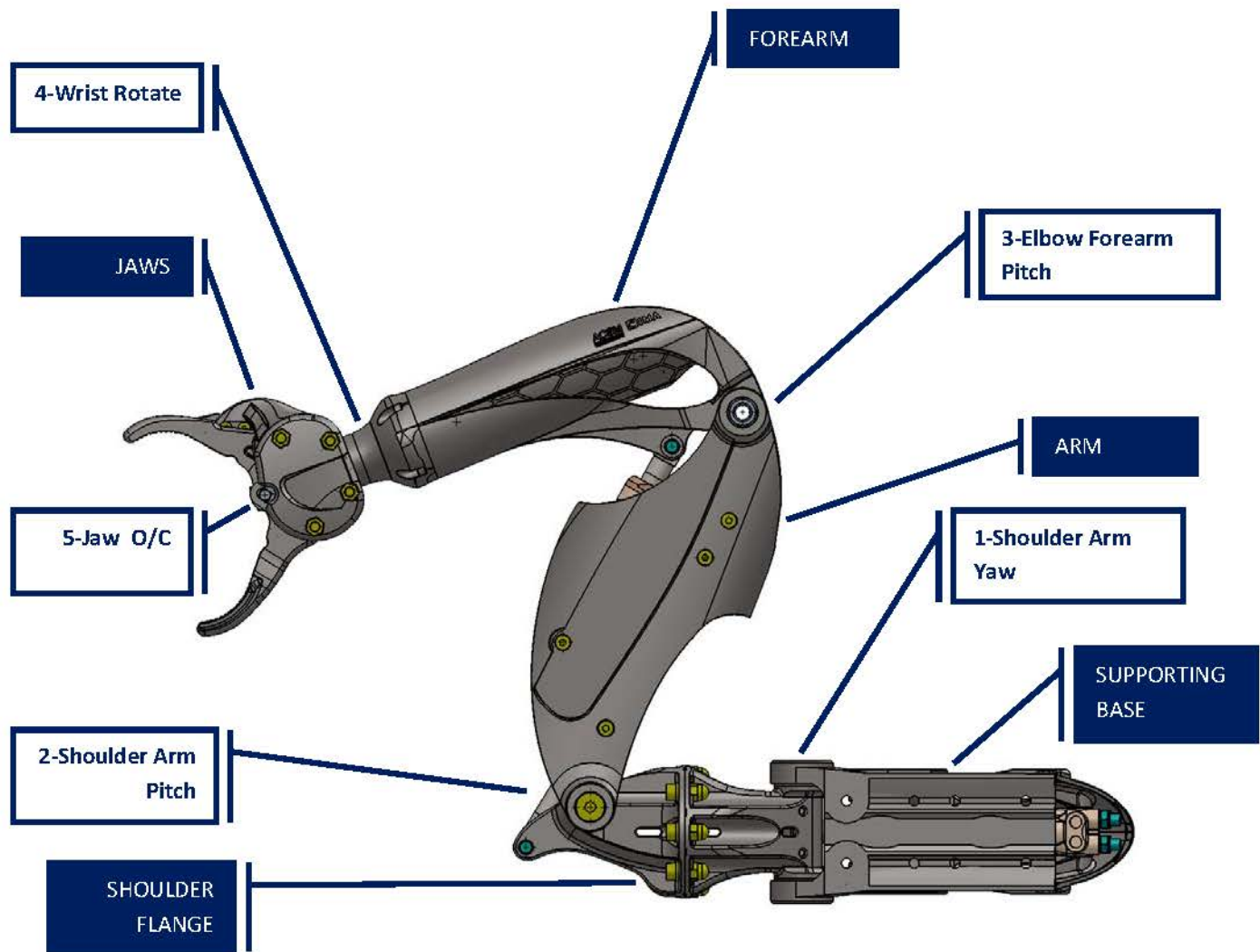


1-INTRODUCTION

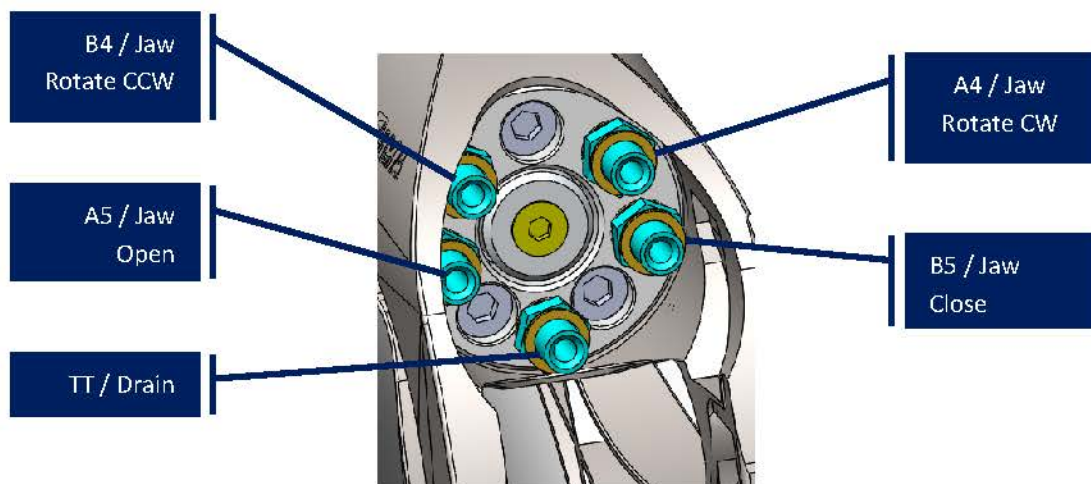
The TITANROB is a titanium built hydraulic manipulator designed for heavy duty subsea applications on ROV (Remote Operated Vehicle) submarine operations. It is a manipulator with enhanced characteristics on weight/power ration and capabilities: By using titanium as main material, lower weight and more mechanical characteristics are achieved, allowing improved dimensioning. By using the same hydraulic power supply, the ROV vehicle has a more powerful and rugged tool, with lower weight and dimensions allowing lower buoyancy needs, and thus improving the ROV vehicle overall capabilities.

The M501 is a five function hydraulic manipulator developed for Light Work Class ROVs. Resistant, lightweight and reliable, it's designed for heavy duty ROV works improving performance and operation. It could be rate operated by any low power (1kW) hydraulic power unit and a five function with drain/comp line valve pack fitted in the ROV vehicle.





M501 main functions and components



Hyd. Motor End cover distributor w/ BSPP 1/8" M fittings and G1/8" bonded washer

2-SPECIFICATIONS

GENERAL SPECIFICATIONS

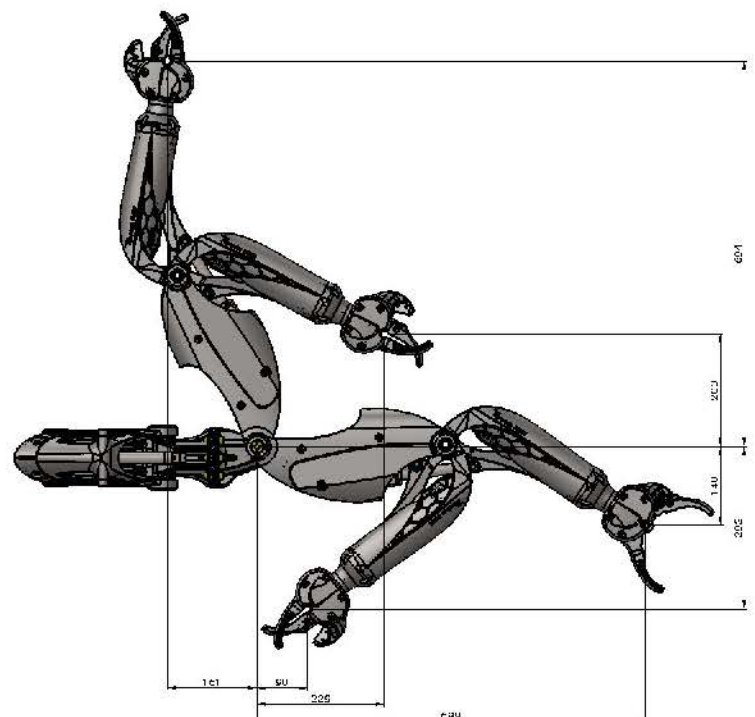
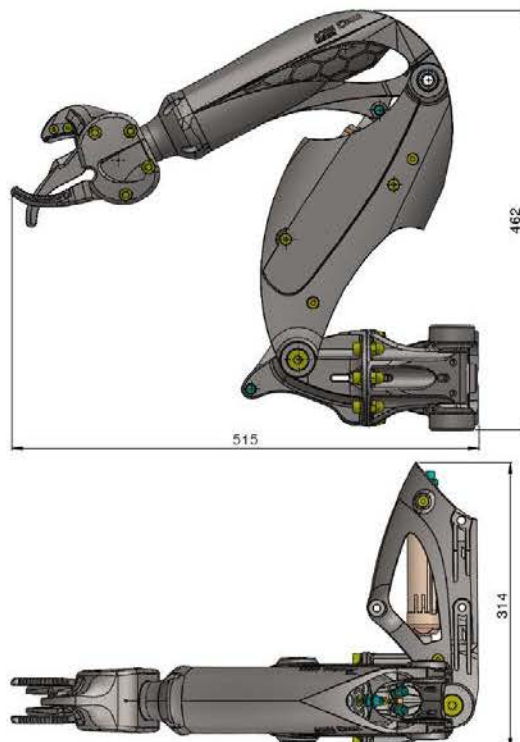
Depth rating (m)	3000
Weight in air (kg)	14
Weight in water (kg)	11
Maximum reach (mm)	950
Lift at full extension (kg)	40 @ 140 bar
Maximum lift (kg)	50 @ 140 bar
Yaw Grip (kgf)	80
Yaw Torque (Nm)	45
Dimensions stowed LxWxH (mm)	300 x 512 x 450
Operating temperature (C), limited by hyd. Oil specs	-5 / +55
Construction Main Materials	Ti6Al4V Titanium AISI 316 SS

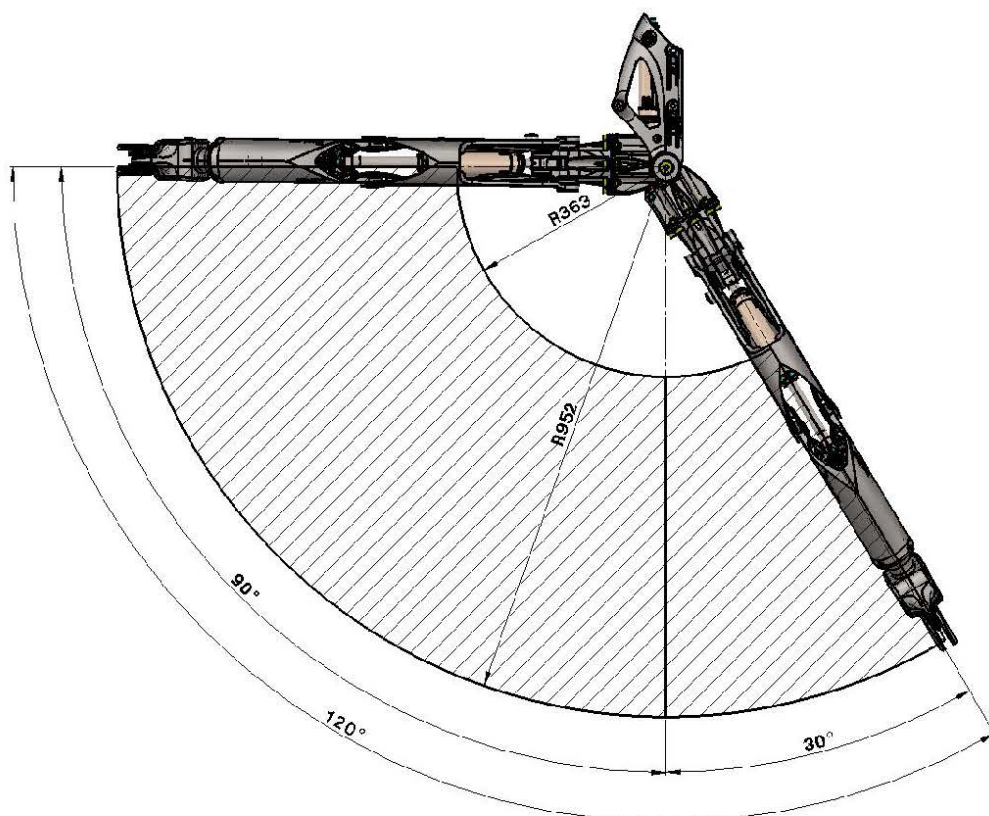
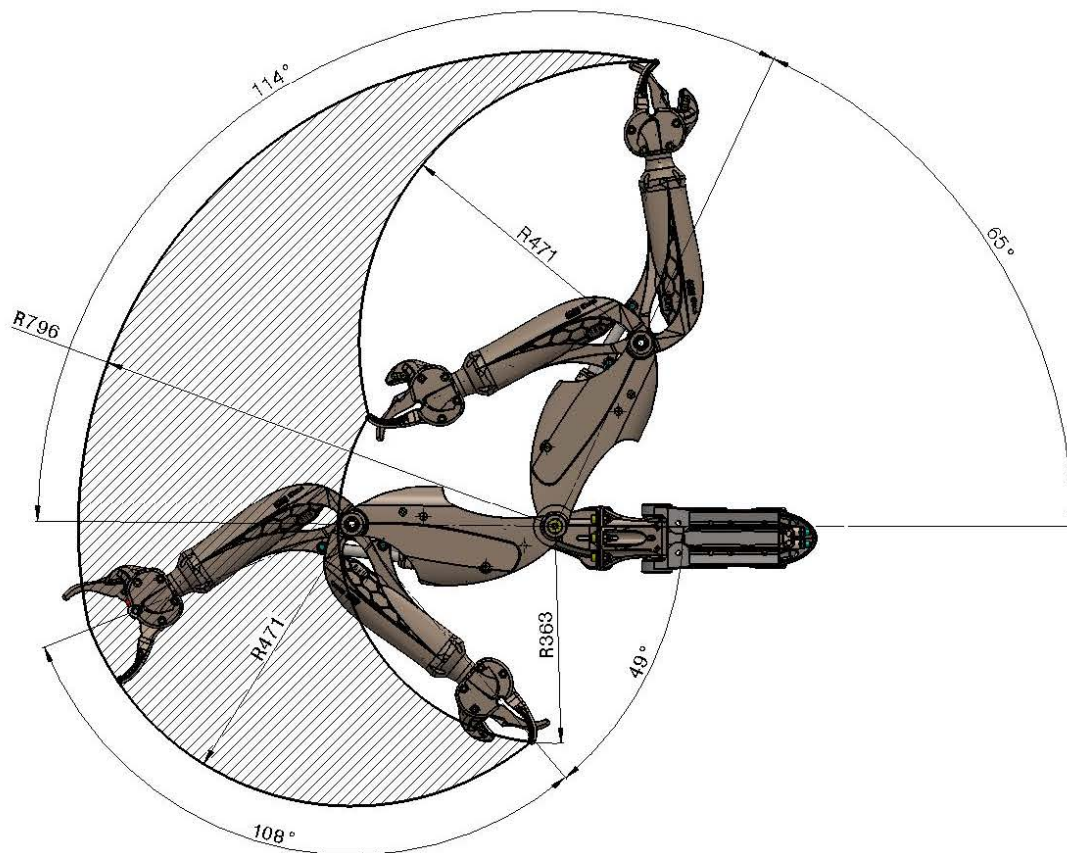
FUNCTIONS

SHOULDER Azimuth (Yaw) (deg)	120 (+90 / -30)
SHOULDER Pitch (deg)	108
ELBOW Pitch (deg)	108
JAW Rotate (deg)	360 continuous
JAW Opening (mm)	168

HYDRAULIC REQUERIMENTS

Standard Hydraulic Oil	ISO 32
Operating pressure (bar)	Up to 160
Operating Flow Rate (lpm)	Min 1.5
Test Pressure (bar)	210
Max. Oil Temp. (C)	55





M501 dimensions and range

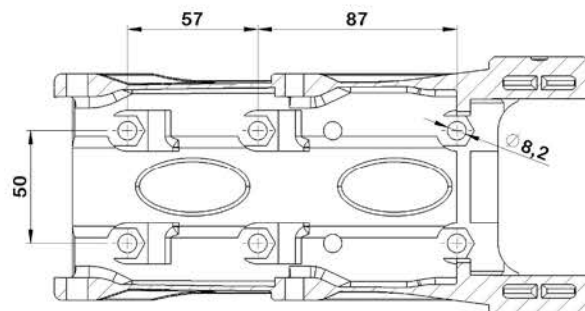
3-INSTALLATION

The five function hydraulic manipulator M501 has eleven (11) hoses to be straight connected to the solenoid valve pack of the ROV hydraulic closed circuit; ten hoses for functions from A1/B1 to A5/B5 and a drain/compensation hose (TT). See annexed list of hoses/functions

- **SAFETY NOTICE:** This is a hydraulic powered equipment, all personnel must wear protective clothing and goggles. Keep a safe area around the equipment when in operation. Ensure that all power is OFF and without pressure when disassembling any of this equipment or carrying out maintenance work. Any maintenance work must be carried out in accordance with standard safety procedures for hydraulic equipment

- **TECHNICAL NOTE:** Shoulder YAW Right / Left (cylinder Extend/Retract) function should be connected to A1 or B1 port depending on Starboard or Port side position of the manipulator. See annexed list of hoses/functions

- Oil supply should be of 140 bar (160 bar maximum), with an average flow of 1,5 l/min. Recommended oil ISO32 (as Shell Tellus T32) with preferable filter rating of 10µm
- Manip valve pack should be supplied with pilot operated solenoid valves with cross piloted check valves, and flow control valves for each function. Equipment must be pressure compensated at all times through the drain (TT) port
- The manip must be bolted and secured to the ROV frame, all hoses fitted and secured, avoiding twists and sharp bends. Check that the Manipulator does not interfere with other vehicle equipment
- All personnel must stand clear of the equipment. Power up HPU and carry out full movements in all its functions. Check oil pressure. Check for leaks
- With the elbow positioned fully up, carefully bleed air by loosening the drain (TT) hose fitting on valve pack end, continuously operating the Yaw rotating function for both directions, and other functions up to their end positions. Also bleed the main oil reservoir/compensator
- Carry out several movement test up to maximum extension and bleed until there isn't any air in the system
- Test the system performance and adjust each flow rate valve to the requested movement speed
- Carry out pre and Post-Dive checks for every dive: fixing bolts tight condition, hydraulic fittings condition and if there is any oil leak, bleed air, oil reservoir level, hydraulic pressure, check movements and adjust flow control, etc.



Supporting Base bolting layout (M8 x 6)

4-OPERATION & MAINTENANCE

The system will be operated as a ROV ancillary hydraulic equipment operated by the vehicle valve pack.

Please stand clear of the equipment when carrying out pre-dive deck checks.

Follow up above point 3 recommended instructions.

Manipulator movements (speed) could be adjusted by the regulation of the valve pack flow control valves.

The Maintenance routine would be as follows:

- The equipment should be washed down with fresh water after ROV recovery on deck, removing any rest of sand from the inner sides of the shoulder flange
 - Inspect the equipment for wear or damage after work
 - The cutter blades are specifically dimensioned to fit each manipulator, therefore blades can't be exchanged
 - Inspect all hoses and fittings condition after work
 - Apply Litium LP2 grease on exposed shafts and hydraulic cylinder rod
 - Use underwater lubricant as "Aqua shield" or "Aqualube" grease on fixing bolts and fitting threads
 - When any ROV Pre-Dive check, confirm functionality and if any oil leakage
 - Bleed for air in the Hyd. Circuit and check oil condition regularly
 - Hydraulic cylinders can be field maintained replacing relevant seals and O-Rings:
 - *Use Molikote 55 grease for O-Rings
 - *Use Loctite 243 mid sealant for the piston rod thread inside the piston
 - *An special tool, a 14 mm spanner, is used to tight the motor end cover fittings, items 29 and 50 on drawing 3053.14.000-000
 - *Use hydraulic oil when replacing cylinder seals
- (see annexed Main Cylinder and Jaw Cylinder drawings)

Motor end cover used as manifold for the Jaw cylinder (item 13)



5-DOCUMENTS & DRAWINGS

SPECIFICATIONS

GENERAL ASSEMBLY (GA) DRAWING

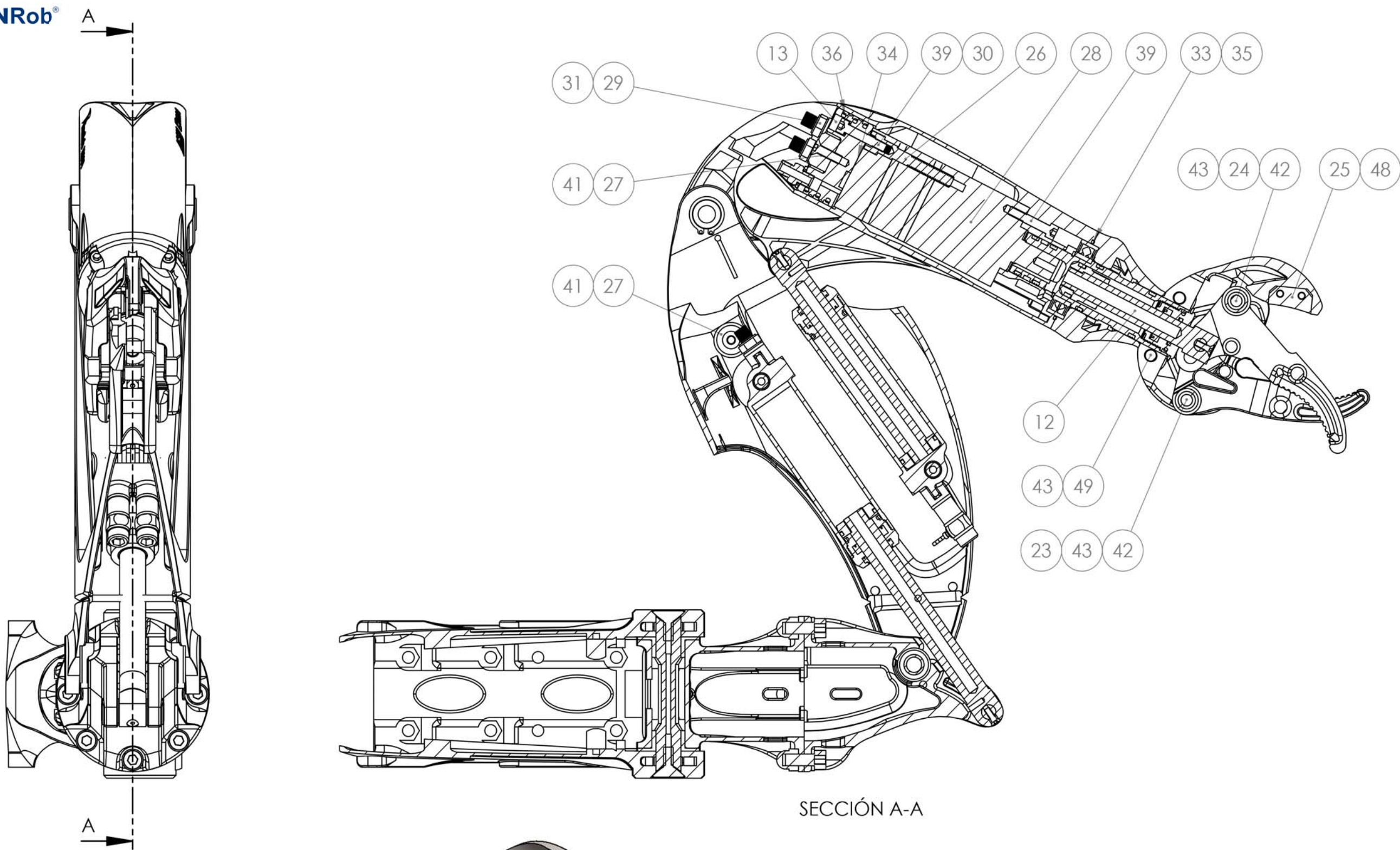
MAIN CYLINDER ASSEMBLY DRAWING

MAIN CYLINDER w/ BANJO ASSEMBLY DRAWING

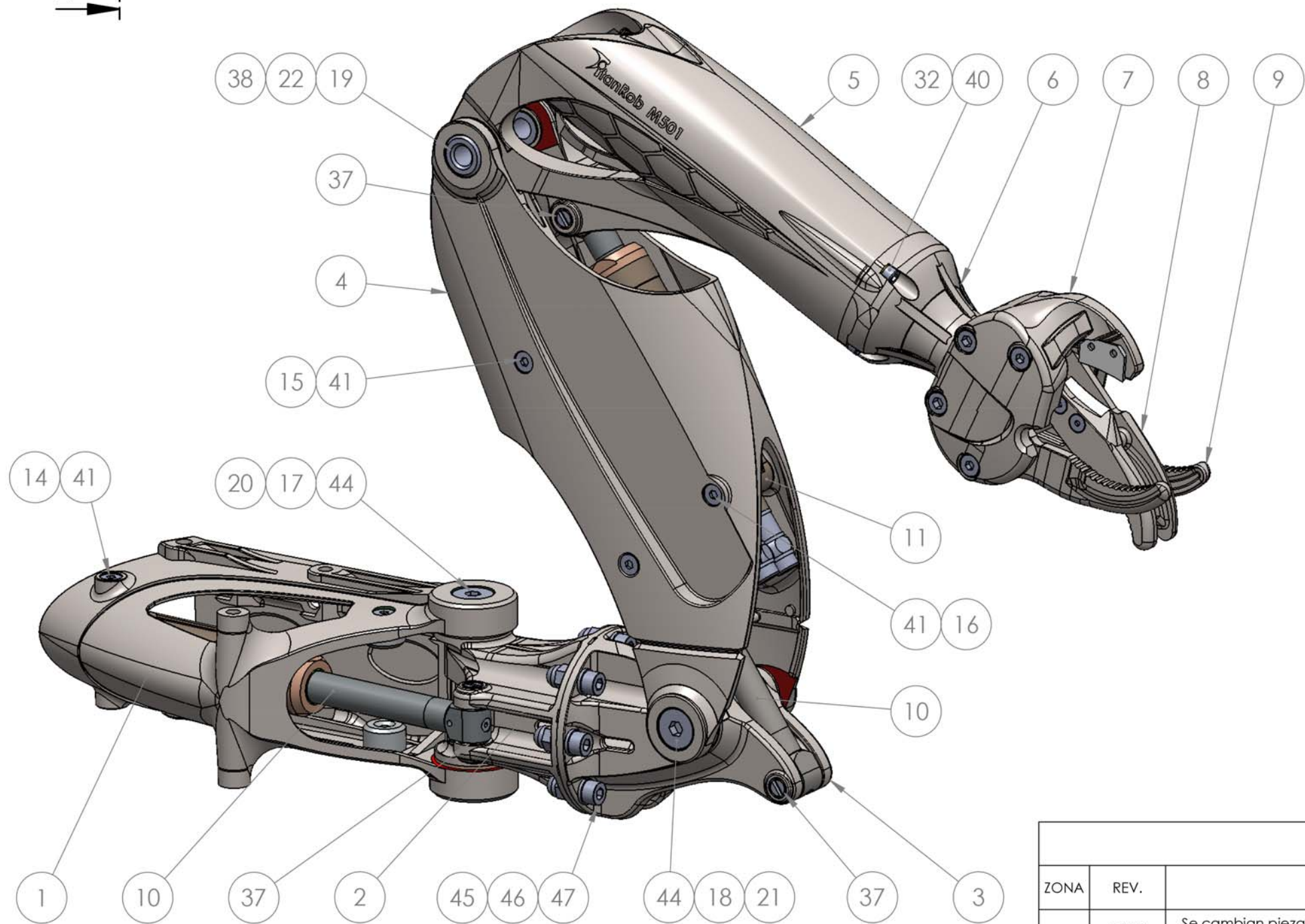
JAW CYLINDER ASSEMBLY DRAWING

PART LIST: Hyd. Hoses

OEM MANUFACTURER INFORMATION: Danfoss OMM50

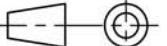


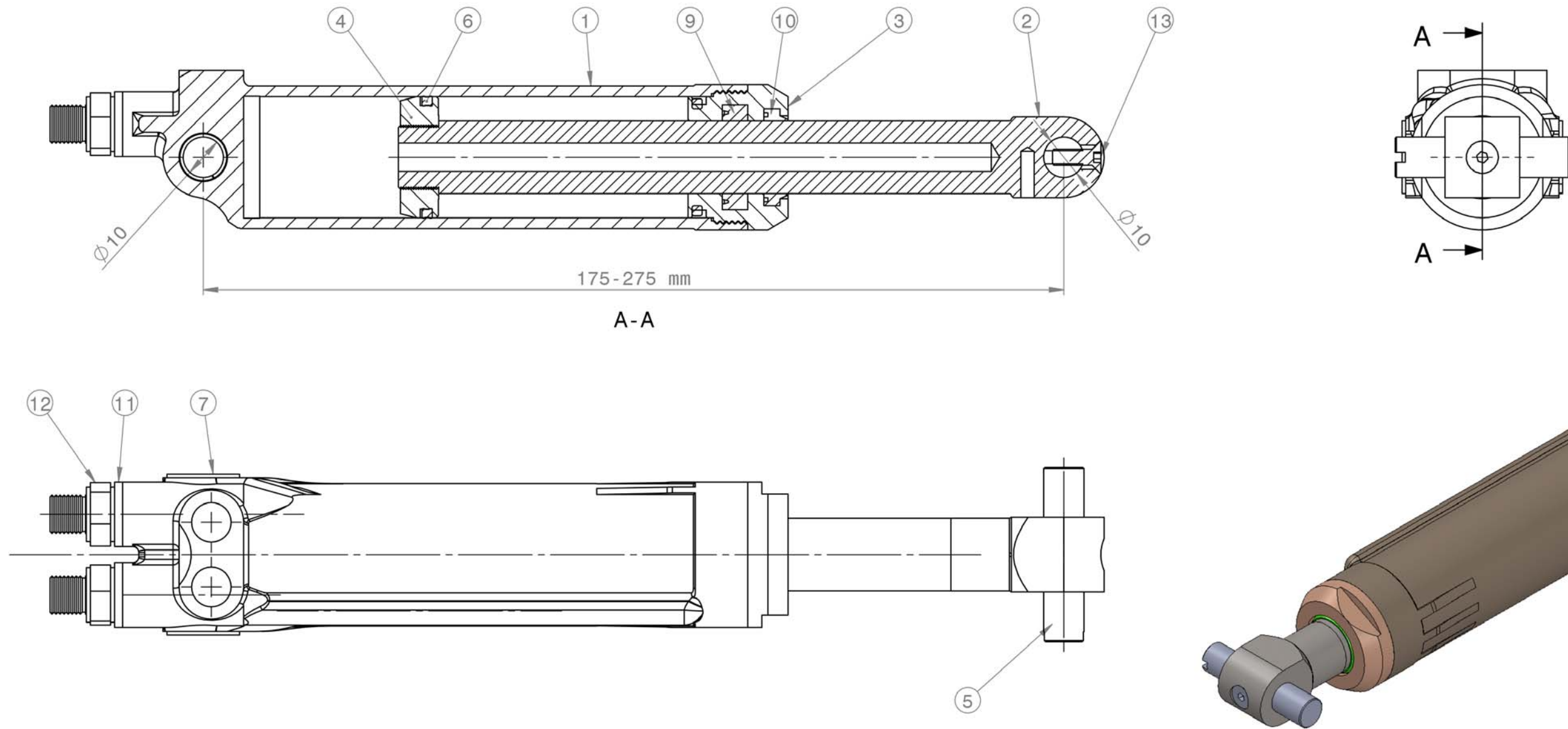
SECCIÓN A-A



REVISIONES				
ZONA	REV.	DESCRIPCIÓN	FECHA	APROBADO
	REV01	Se cambian piezas 201 por casquillos comerciales. Se crea conjunto 200. Se añaden piezas 302.	7oct2015	P. Iglesias

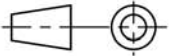
ITEM	MANUFAC. / SUPPLIER REF.	DESCRIPTION	QTY.
1	3053.14.000-001-R01	SUPPORTING BASE	1
2	3053.14.000-002-R02	YAW FLANGE	1
3	3053.14.000-003-R02	SHOULDER FLANGE	1
4	3053.14.000-004-R01	ARM	1
5	3053.14.000-005-R04	FOREARM	1
6	3053.14.000-006-R03	WRIST BEARING COVER	1
7	3053.14.000-007-R02	JAW BODY	1
8	3053.14.000-008-R01	UPPER JAW	1
9	3053.14.000-009-R01	LOWER JAW	1
10	3053.14.000-100-R01	CYLINDER MAIN ASSY.	2
11	3053.14.000-200	CYLINDER MAIN ASSY.	1
12	3053.14.000-400-R01	CYLINDER JAW ASSY.	1
13	3053.14.000-101-R02	MOTOR END COVER	1
14	3053.14.000-203	SHAFT CYL. #1	1
15	3053.14.000-204	SHAFT CYL. #2	1
16	3053.14.000-205	SHAFT CYL. #3	1
17	3053.14.000-206-R02	YAW SHAFT	1
18	3053.14.000-207-R02	SHOULDER PITCH SHAFT	1
19	3053.14.000-208-R01	ELBOW PITCH PIVOT SHAFT	2
20	3053.14.000-209	BRONZE BUSH (Yaw Shaft)	2
21	3053.14.000-210	BRONZE BUSH (Shoulder Shaft)	2
22	3053.14.000-211	BRONZE BUSH (Elbow Pin)	4
23	3053.14.000-212	BRONZE BUSH (Lower Jaw)	1
24	3053.14.000-214	BRONZE BUSH (Upper Jaw)	1
25	3053.14.000-301	CUTTER INOX	2
26	3053.14.000-302	SPECIAL BOLT M8-M6	3
27	3053.14.000-304	ANODE Ø24	5
28	BIBUS 151G0037	OMM 50 DANFOSS HYD. MOTOR	1
29	RODAVIGO 204Z101002	FITTING BSPP 1/8" M-M INOX	5
30	EPIDOR 457.622	BONDED WASHER M6 GAL	3
31	RODAVIGO 203ZVT21002	BONDED WASHER G1/8" INOX	5
32	EPIDOR 552.521	COPPER WASHER 6-10-1	4
33	EPIDOR 691.139	O-RING 56x2	1
34	EPIDOR 667.089	O-RING 23x1	2
35	EPIDOR 340.653	O-RING 2,5x2	2
36	EPIDOR 363.770	O-RING 54x3	3
37	EPIDOR 673.152	BUSH PTFE BB-1012DU-B	6
38	DIN 471 D20	CIRCLIP Ø20 INOX	2
39	DIN 912 M6x30	BOLT DIN 912 M6x30	6
40	DIN 912 M6x20	BOLT DIN 912 M6x20	4
41	DIN 7991 M6x20	COUNTERSUNK BOLT DIN 7991 M6x20	11
42	DIN 7984 M8x60	LOW HEAD BOLT DIN 7984 M8x60	2
43	DIN 934 M8	NUT DIN 934 M8	4
44	DIN 7991 M12x20	COUNTERSUNK BOLT DIN 7991 M12x20	4
45	DIN 127 M8	LOCK WASHER DIN 127 M8	8
46	DIN 1587 M8	ACORN NUT DIN 1587 M8	8
47	DIN 912 M8x20	BOLT DIN 912 M8x20	8
48	DIN 7991 M5x10	COUNTERSUNK BOLT DIN 7991 M5x10	4
49	DIN 912 M8x60	BOLT DIN 912 M8x60	2

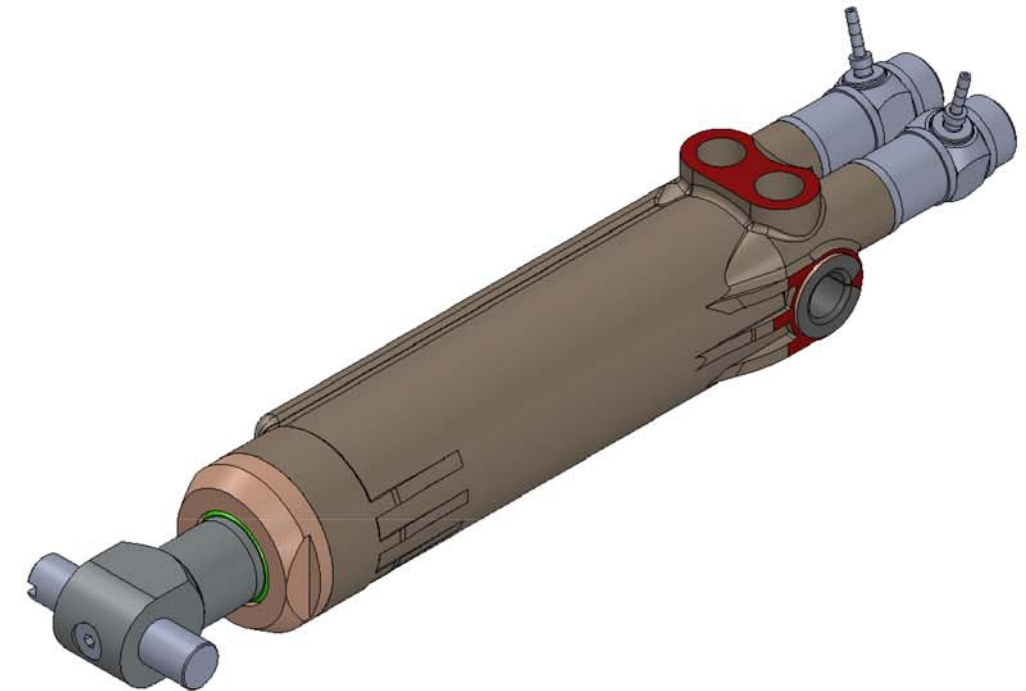
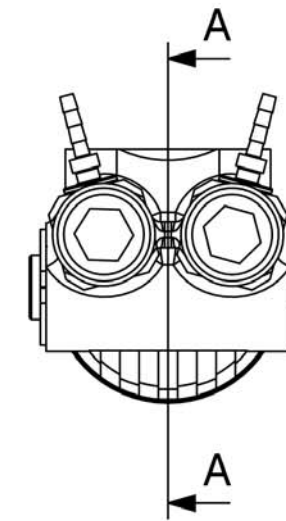
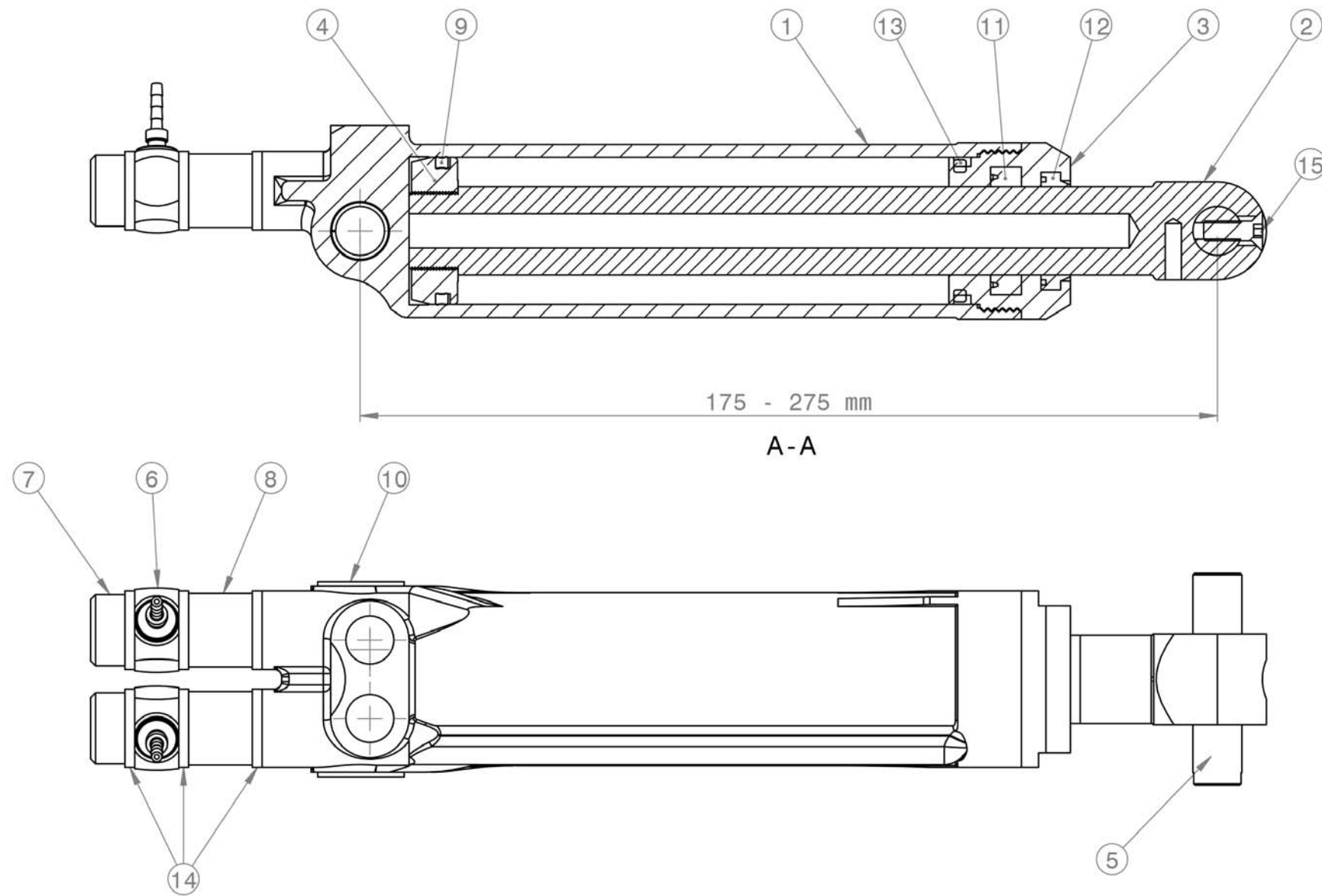
 TITANRob® is a registered trademark of Quantum Innovative SL CIF: B27725225 Porto do Molle, Rúa das Pontes, nº19, CP:36350, Nigrán (Pontevedra) SPAIN	Fecha original	Dibujado	Comprobado	 ( )		MATAR ARISTAS 0,5 x45°	
	31/03/2015	JM Taibo	P. Iglesias				
	Proyecto M501					COTAS SIN TOLERANCIA SEGÚN ISO 2768 mK	
				Material		Tratamiento	
	Designación					Proceso	
	STANDAR SPARE KIT - M501 MAIN ASSY.					Montaje	
	Nº de plano		Cant.		Escala	Formato	Hoja
	3053.14.000-000-R01				1:10	A2	1 de 1



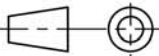
ITEM	MANUFAC. / SUPPLIER REF.	DESCRIPTION	QTY.
1	3053.14.000-010-R01	CYLINDER BODY Ø30X100	1
2	3053.14.000-106-R01	PISTON ROD	1
3	3053.14.000-107-R01	CYLINDER HEAD	1
4	3053.14.000-108-R02	PISTON	1
5	3053.14.000-202-R02	ROD PIN	1
6	3053.14.000-310	SEAL PU88 Ø30	1
7	EPIDOR 673.152	CUSHION PTFE BB-1012DU-B	2
8	EPIDOR 472.147	O-RING 24x2,5	1
9	EPIDOR 640.300	ROD SEAL Ø18	1
10	EPIDOR 337.847	WIPER SEAL PU11 18x24x4	1
11	RODAVIGO 203ZVT21002	BONDED WASHER G1/8" INOX	2
12	RODAVIGO 204Z101002	FITTING BSPP 1/8" M-M INOX	2
13	DIN 7991 M4x12	COUNTERSUNK BOLT M4X12	1

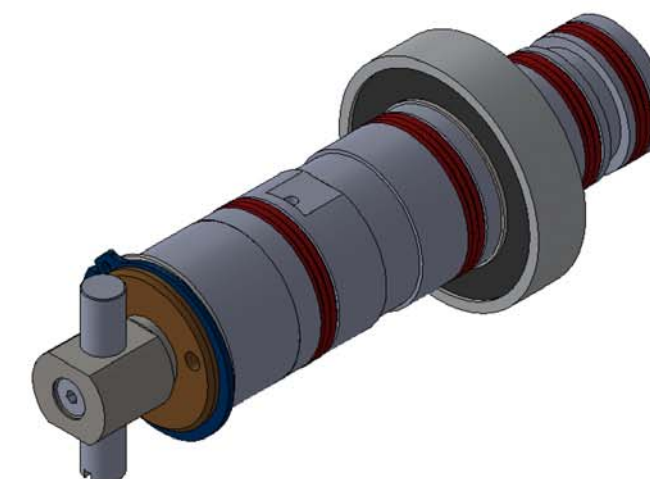
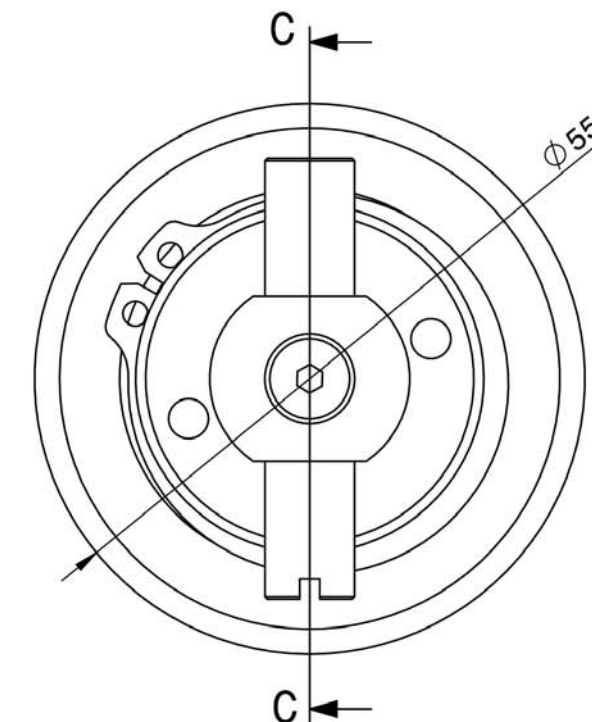
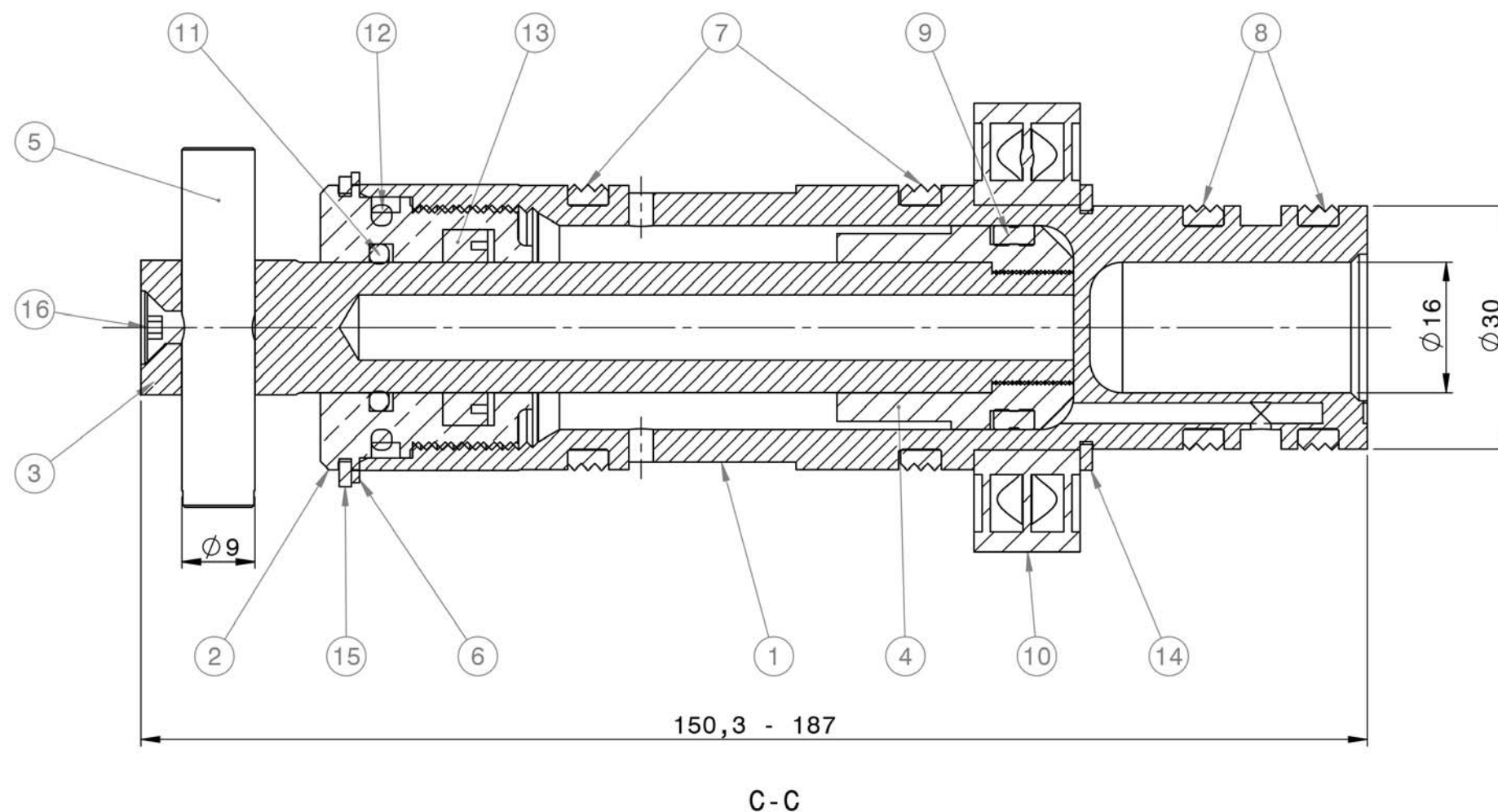
REVISIONES				
ZONA	REV.	DESCRIPCIÓN	FECHA	APROBADO
	R01	Se sustituye junta torica por junta mecanizada PU88 en el émbolo	29sep2015	P. Iglesias

TITANRob® TITANRob® is a registered trademark of Quantum Innovative SL CIF: B27725225 Porto do Molle, Rúa das Pontes, nº19, CP:36350, Nigrán (Pontevedra) SPAIN	Fecha original	Dibujado	Comprobado	MATAR ARISTAS 0,5 x45°			
	24/11/2014	JMTaibo	Pablo Iglesias				
	Proyecto M501 / G500				COTAS SIN TOLERANCIA SEGUN ISO 2768 mK		
					Material	Tratamiento	Peso 0.54 Kg.
	Designación STANDAR SPARE KIT - CYLINDER MAIN ASSY.			Proceso MONTAJE			
Nº de plano 3053.14.000-100-R01			Cant.	Escala 1:1	Formato A3	Hoja 1 de 1	

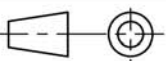


ITEM	MANUFAC. /SUPPLIER REF.	DESCRIPTION	QTY.
1	3053.14.000-010-R01	CYLINDER BODY Ø30X100	1
2	3053.14.000-106-R01	PISTON ROD	1
3	3053.14.000-107-R01	CYLINDER HEAD	1
4	3053.14.000-108-R02	PISTON	1
5	3053.14.000-202-R02	ROD PIN	1
6	3053.14.000-305	FITTING BSPP 1/8" BANJO INOX	2
7	3053.14.000-306	BANJO SCREW 1/8"	2
8	3053.14.000-307	SPACER 1/8"	2
9	3053.14.000-310	SEAL PU88 Ø30	1
10	EPIDOR 673.152	CUSHION PTFE BB-1012DU-B	2
11	EPIDOR 640.300	ROD SEAL Ø18	1
12	EPIDOR 337.847	WIPER SEAL PU11 18x24x4	1
13	EPIDOR 472.147	O-RING 24x2,5	1
14	RODAVIGO 203ZVT21002	BONDED WASHER G1/8" INOX	6
15	DIN 7991 M4x12	COUNTERSUNK BOLT M4X12	1

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	24/11/2014	JMTaibo	Pablo Iglesias				
	Proyecto M501 / G500					COTAS SIN TOLERANCIA SEGUN ISO 2768 mK	
				Material	Tratamiento	Peso 0.59 Kg.	
	Designación					Proceso	
	CYLINDER MAIN ASSY.					MONTAJE	
	Nº de plano			Cant.	Escala	Formato	Hoja
	3053.14.000-200			-	1:1	A3	1 de 1



REVISIONES				
ZONA	REV.	DESCRIPCIÓN	FECHA	APROBADO
	REV01	Se sustituye fôrica por rascador, se instalan 5 juntas mecanizadas de PU88 en las estanqueidades dinâmicas.	29sep2015	P. Iglesias

TITANRob® TITANRob® is a registered trademark of Quantum Innovative SL CIF: B27725225 Porto do Molle, Rúa das Pontes, nº19, CP:36350, Nigrán (Pontevedra) SPAIN	Fecha original	Dibujado	Comprobado			MATAR ARISTAS 0,5 x45°	
	28/11/2014	JMTaibo	Pablo Iglesias			COTAS SIN TOLERANCIA SEGÚN ISO 2768 mK	
	Proyecto			Material	Tratamiento	Peso	
	M501					0.67 Kg	
	Designación					Proceso	
	STANDAR SPARE KIT - CYLINDER JAW ASSY.					MONTAJE	
	Nº de plano			Cant.	Escala	Formato	Hoja
	3053.14.000-400-R01				1.5:1	A3	1 de 1

ITEM	MANUFAC. /SUPPLIER REF.	DESCRIPTION	QTY.
1	3053.14.000-102-R01	CYLINDER JAW BODY	1
2	3053.14.000-103-R02	CYLINDER HEAD	1
3	3053.14.000-104-R01	PISTON ROD	1
4	3053.14.000-105-R01	PISTON	1
5	3053.14.000-213-R01	JAW PIN	1
6	3053.14.000-215	JAW LIMIT RING	1
7	3053.14.000-308	SEAL ROT. Ø35 PU88	2
8	3053.14.000-309	SEAL ROT. Ø30 PU88	2
9	3053.14.000-311	PISTON SEAL Ø25 PU88	1
10	6006.2RSR.C3 - FAG	BEARING 55x30x13	1
11	EPIDOR 373.293	O-RING 15,6x2,4	1
12	EPIDOR 694.562	O-RING 25x2,5	1
13	EPIDOR 504.050	ROD SEAL Ø16	1
14	DIN 471 D30	CIRCLIP Ø30 INOX	1
15	DIN 471 D35	CIRCLIP Ø35 INOX	1
16	DIN 7991 M4x12	COUNTERSUNK BOLT DIN 7991 M4x12	1



TITANROB MANIPULATOR HYDRAULIC HOSE LIST

Equipment	M501 Manipulator	Ref.	3053.14.000
S/N	007+008 ALLSEAS	Date	15feb2018
Assembly	HYDRAULIC HOSES	Revised by	PIN

No.	FUNCTION	Actuator	Valve Pack Port No.	DWG Ref. / Pos.	Hose Length (mm)	Manip end Fitting	V Pack end Fitting	Hose Type	QTY.
1	SHOULDER / ARM Azimuth (Yaw) RIGHT	Extend (RH) Retract (LH)	A1	N/A	1050	BSPP 1/8" F Swivel	BSPP 1/8" F Swivel	Parker 2020N-012V30	1
2	SHOULDER / ARM Azimuth (Yaw) LEFT	Retract (RH) Extend (LH)	B1	N/A	1050	BSPP 1/8" F Swivel	BSPP 1/8" F Swivel	Parker 2020N-012V30	1
3	SHOULDER / ARM Pitch UP	Extend	A2	N/A	1850	BSPP 1/8" F Swivel	BSPP 1/8" F Swivel	Parker 2020N-012V30	1
4	SHOULDER / ARM Pitch DOWN	Retract	B2	N/A	1850	BSPP 1/8" F Swivel	BSPP 1/8" F Swivel	Parker 2020N-012V30	1
5	ELBOW / FOREARM Pitch UP	Extend	A3	N/A	1650	BANJO	BSPP 1/8" F Swivel	Parker 2020N-012V30	1
6	ELBOW / FOREARM Pitch DOWN	Retract	B3	N/A	1650	BANJO	BSPP 1/8" F Swivel	Parker 2020N-012V30	1
7	JAW Rotate CW	Rotate CCW	A4	N/A	1900	BSPP 1/8" F Swivel	BSPP 1/8" F Swivel	Parker 2020N-012V30	1
8	JAW Rotate CCW	Rotate CW	B4	N/A	1900	BSPP 1/8" F Swivel	BSPP 1/8" F Swivel	Parker 2020N-012V30	1
9	JAW Rotate DRAIN	N/A	TT	N/A	1900	BSPP 1/8" F Swivel	BSPP 1/8" F Swivel	Parker 2020N-012V30	1
10	JAW CLOSE	Retract	A5	N/A	1900	BSPP 1/8" F Swivel	BSPP 1/8" F Swivel	Parker 2020N-012V30	1
11	JAW OPEN	Extend	B5	N/A	1900	BSPP 1/8" F Swivel	BSPP 1/8" F Swivel	Parker 2020N-012V30	1