PONTIFICIA UNIVERSIDAD CATÓLICA DEL PERÚ

FACULTAD DE CIENCIAS E INGENIERÍA

DISEÑO DE UN BANCO DE PRUEBAS PARA BOMBAS DE PISTONES AXIALES CON SENSOR DE CARGA DE HASTA 140 CC/REV

ANEXOS

Tesis para optar el Título de Ingeniero Mecánico, que presenta el bachiller:

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Lima, Junio del 2016

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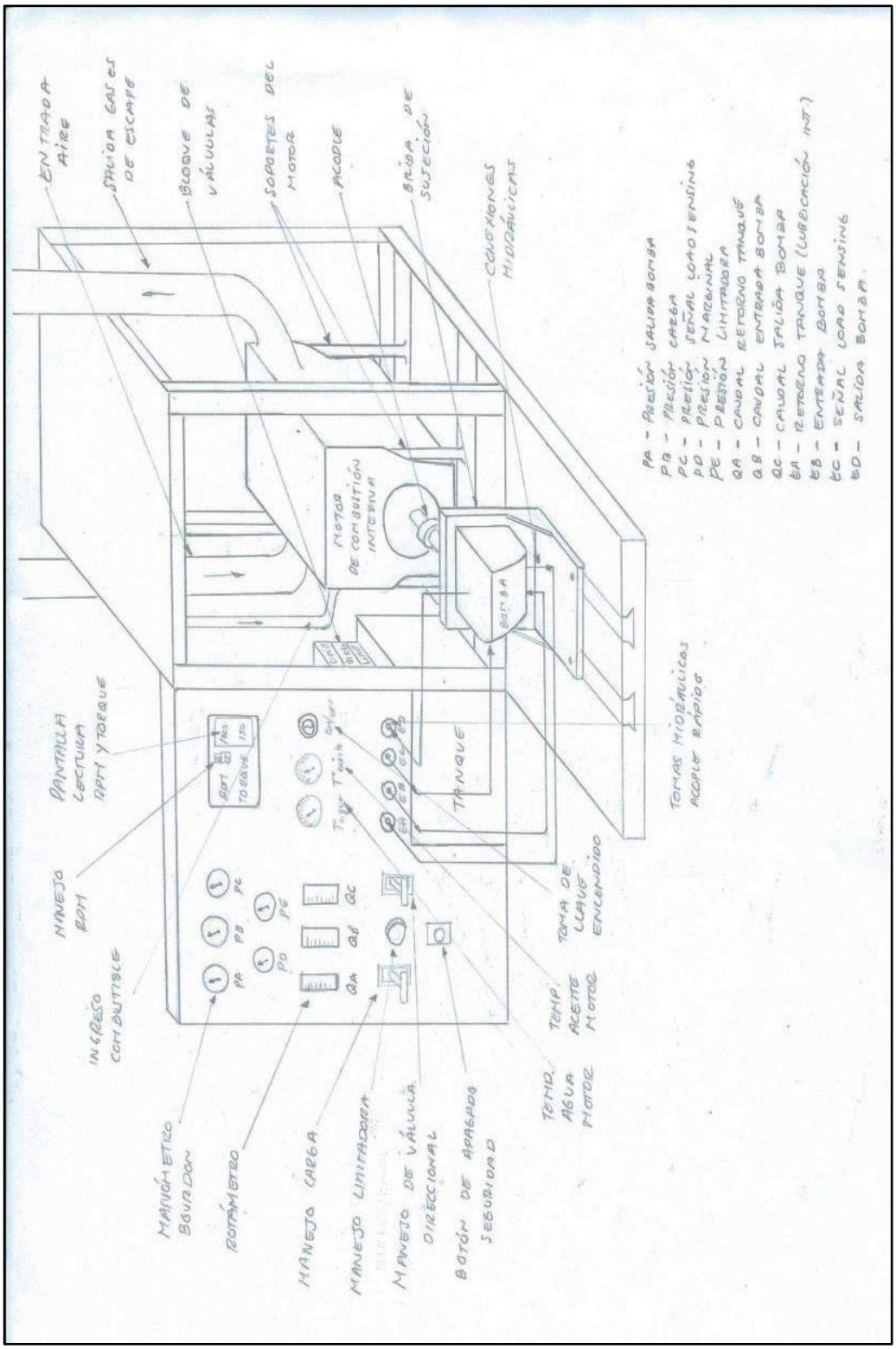


Figura 1.1. Concepto de solución 1

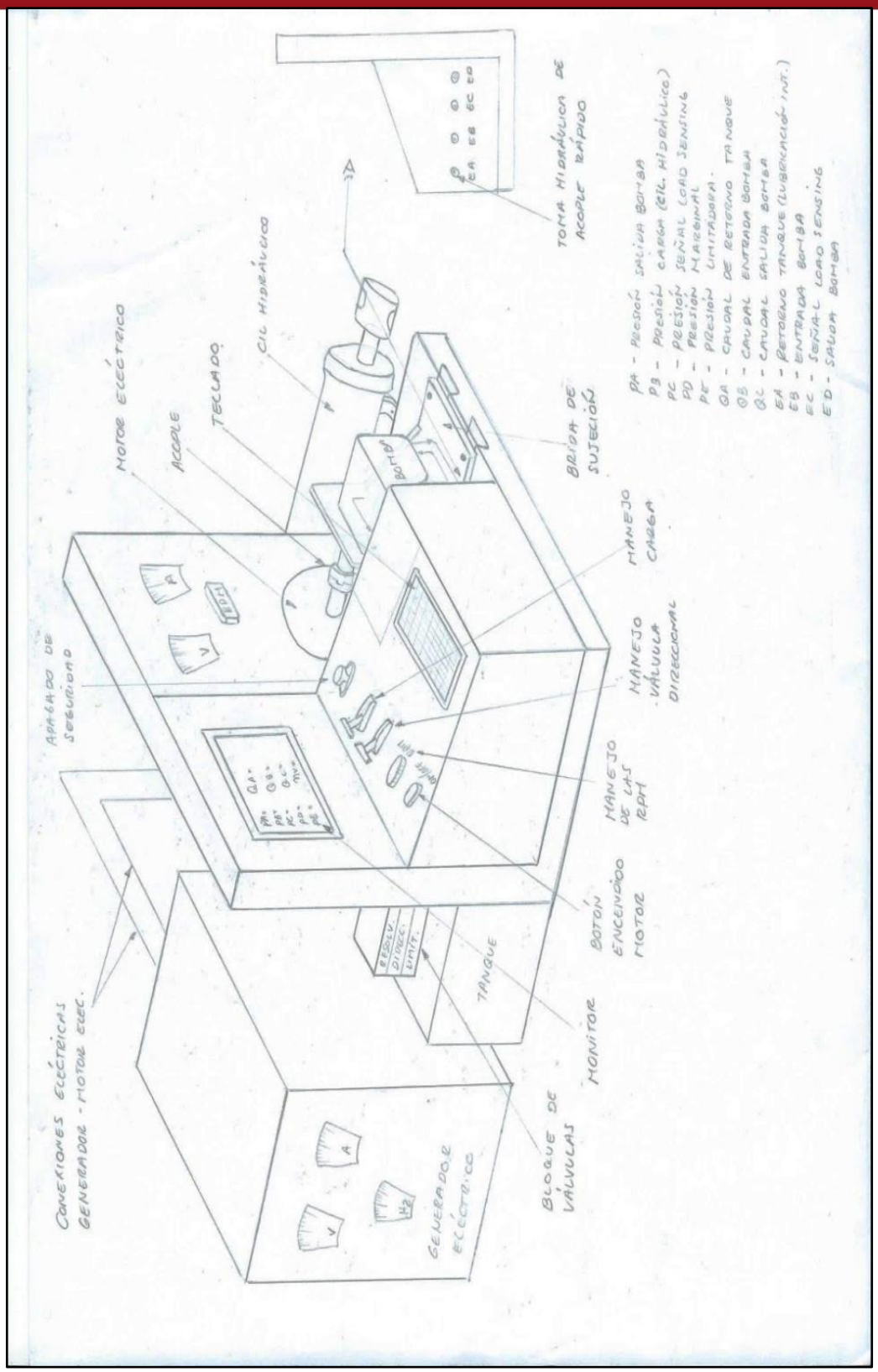


Figura 1.2. Concepto de solución 2

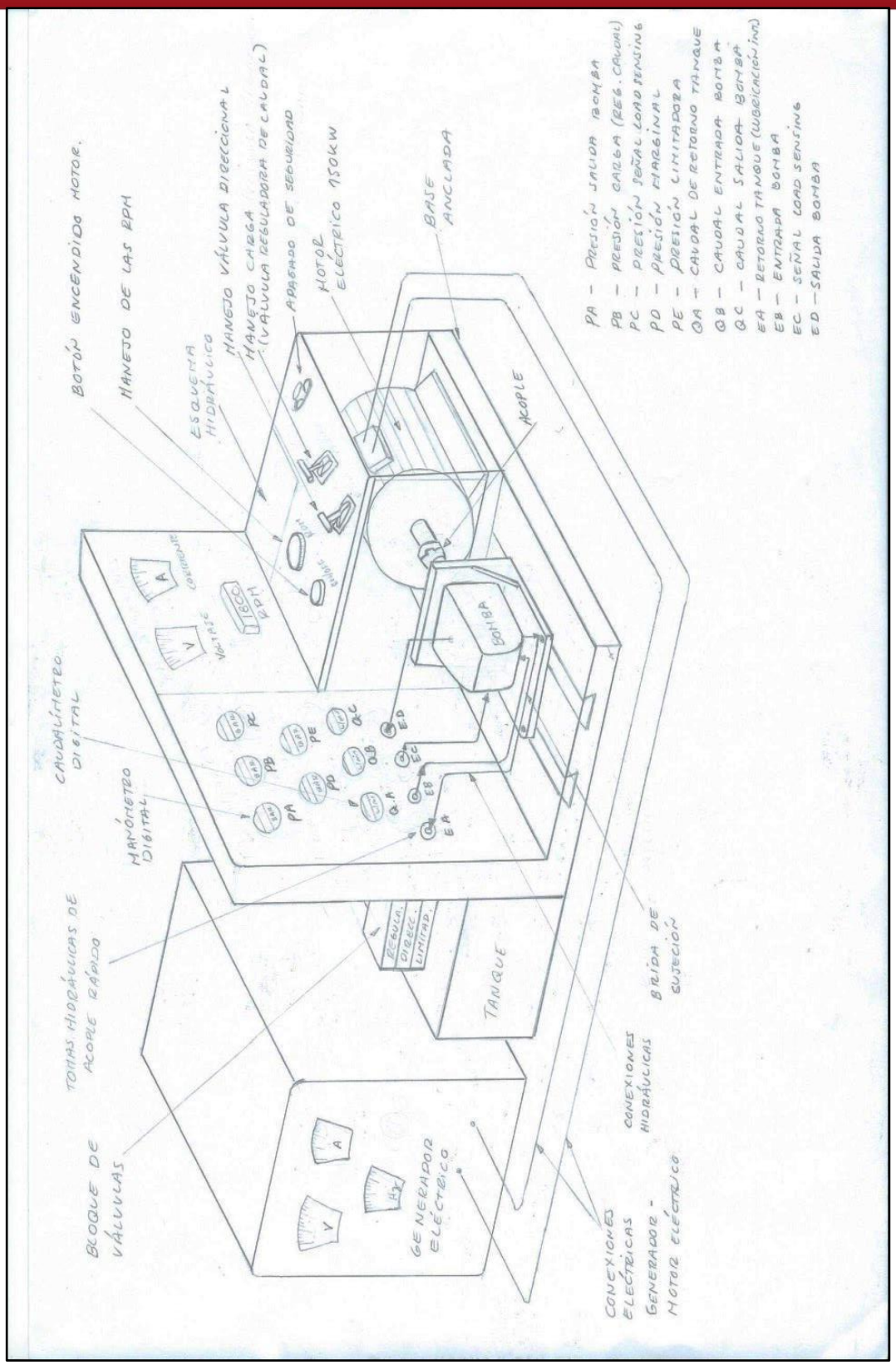


Figura 1.3. Concepto de solución 3

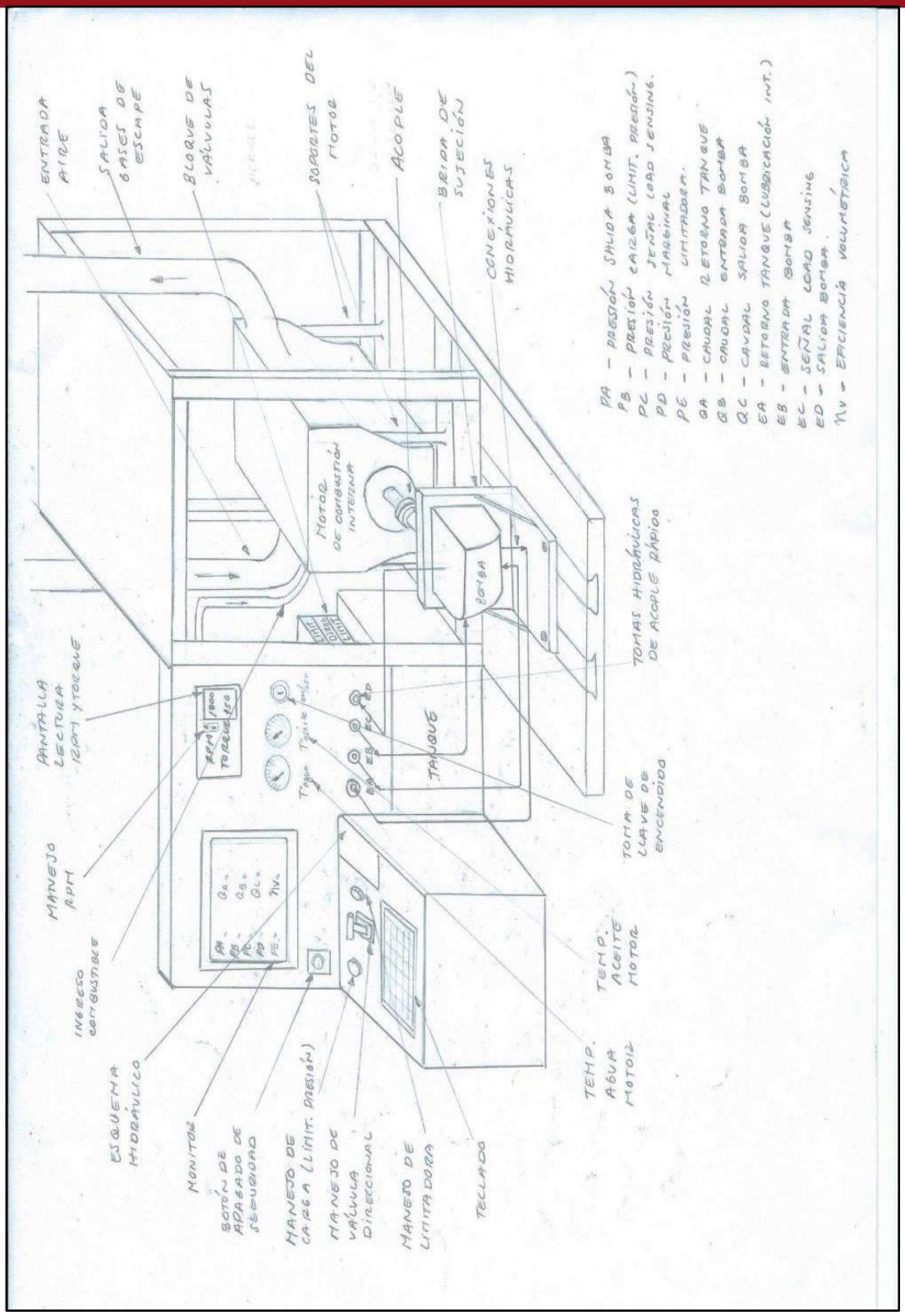


Figura 1.4. Concepto de solución 4

ANEXO 2. Proyecto preliminar

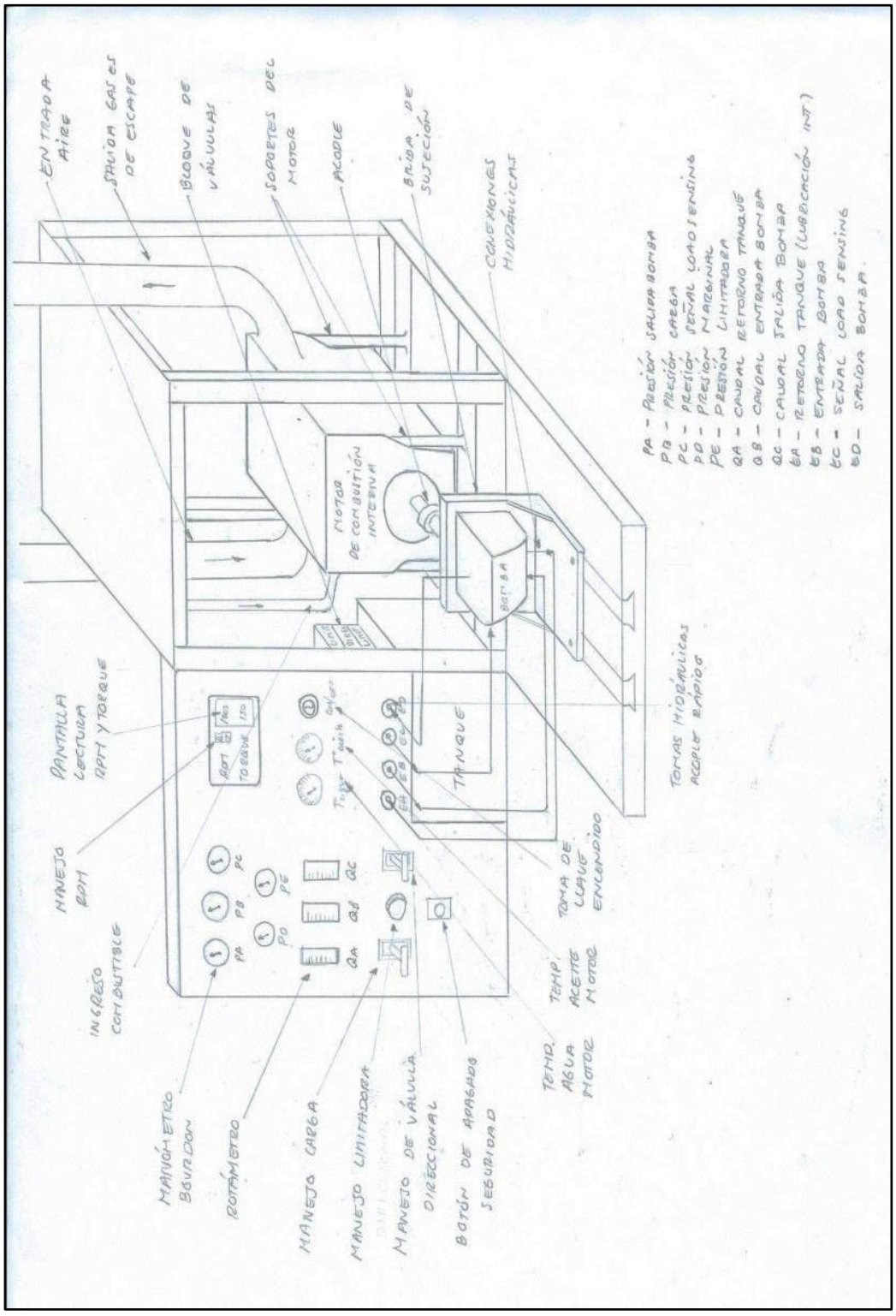


Figura 2.1. Proyecto preliminar 1

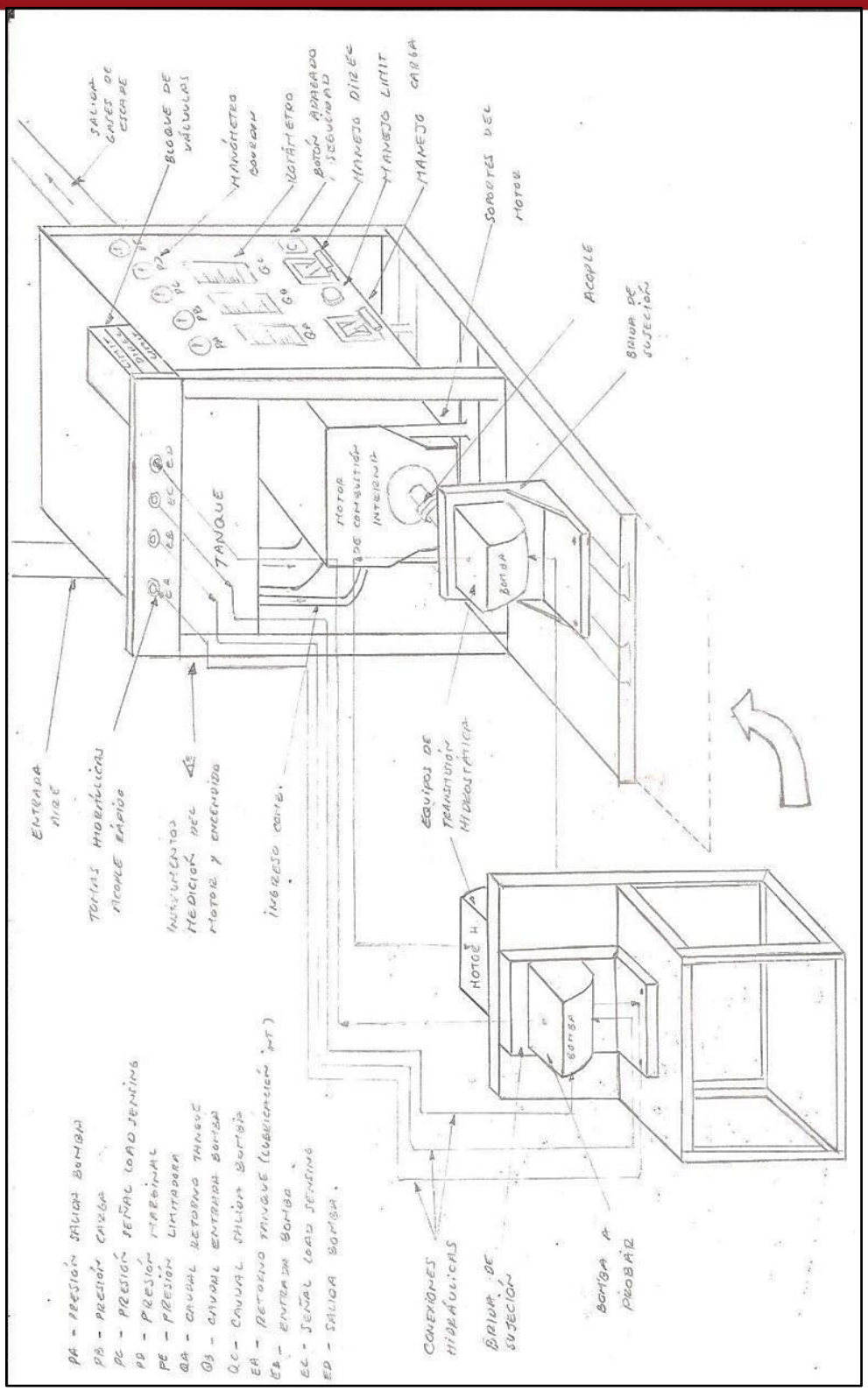


Figura 2.2. Proyecto preliminar 2

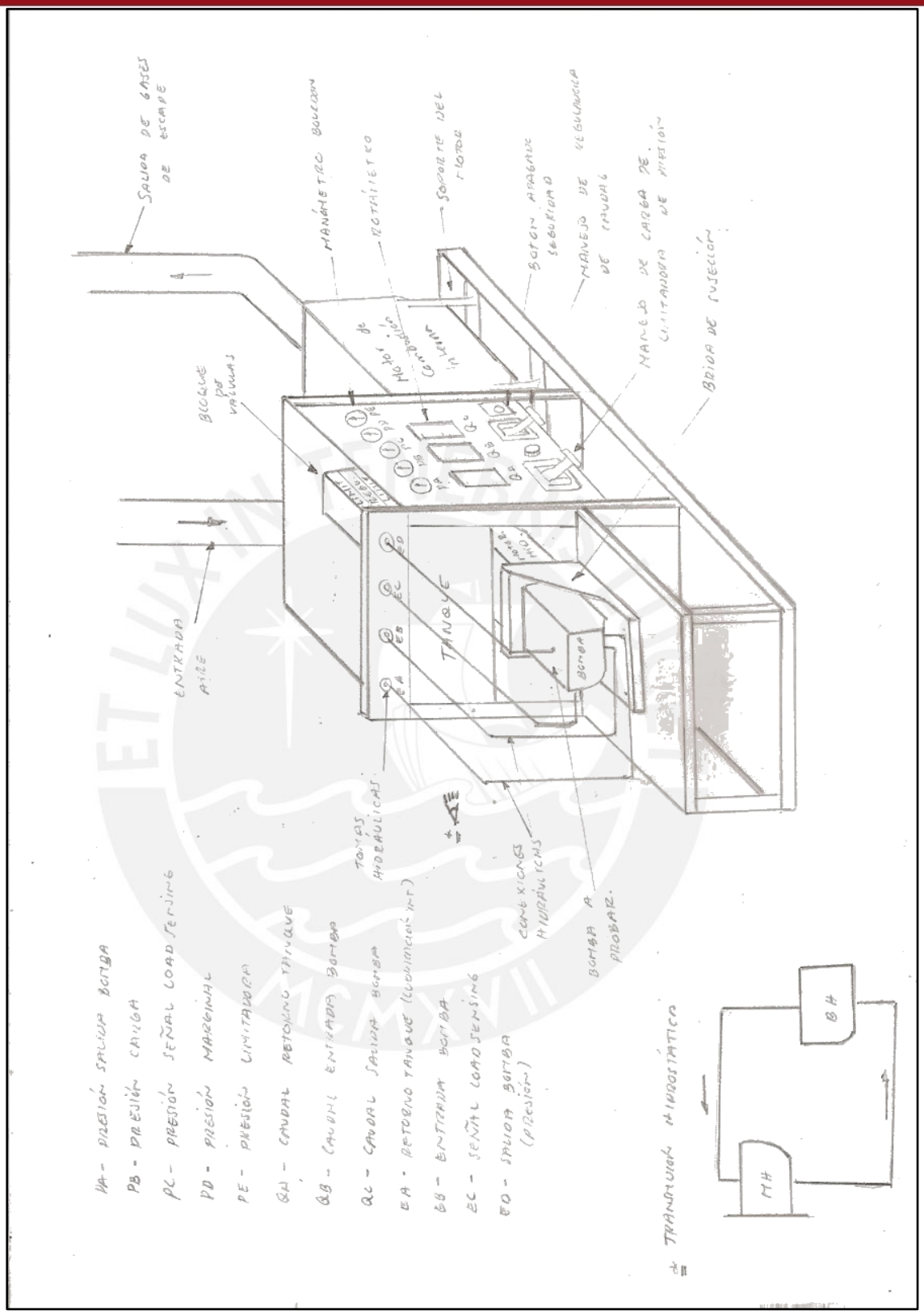


Figura 2.3. Proyecto definitivo

ANEXO 3. Procesos de prueba

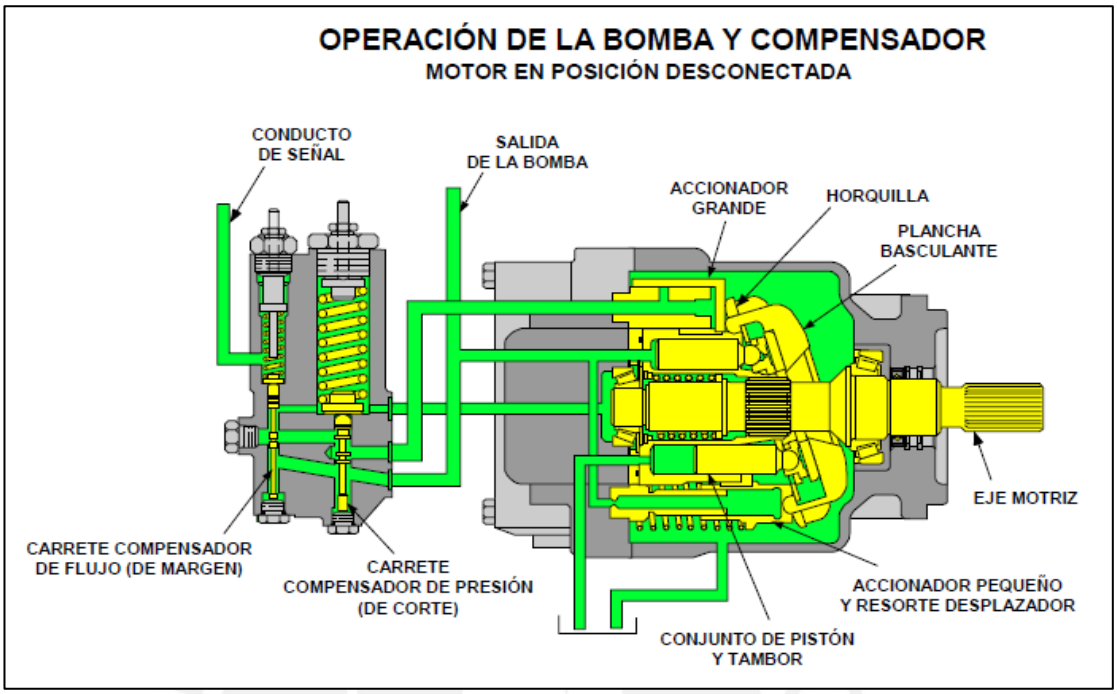


Figura 3.1. Bomba en situación 1)

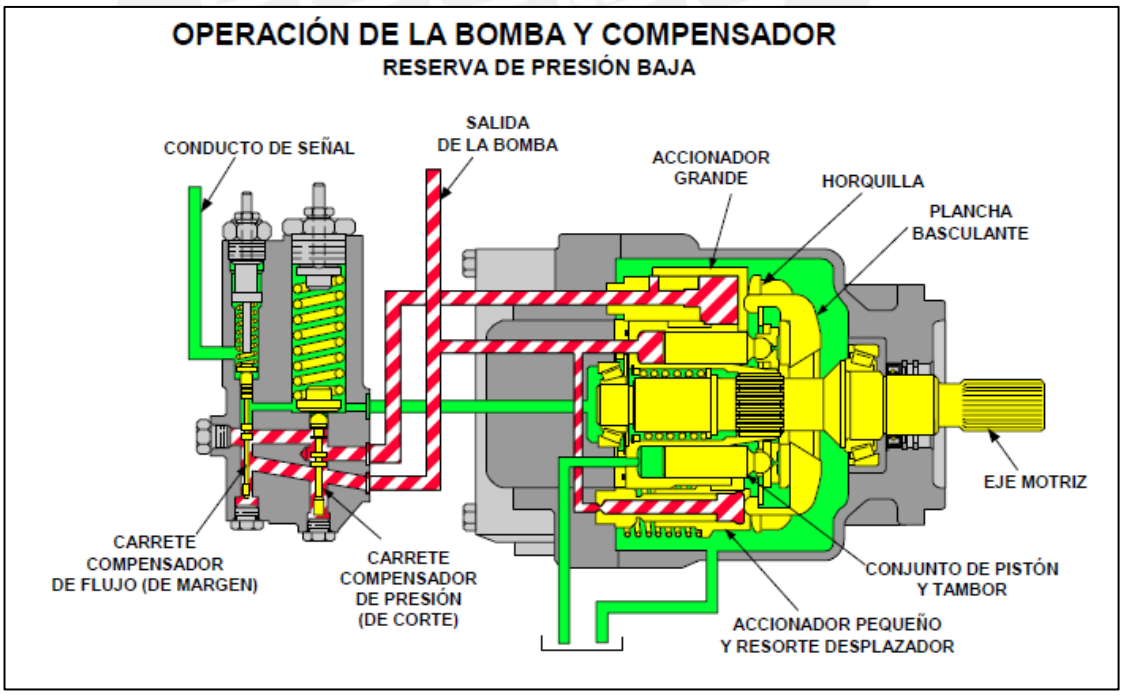


Figura 3.2. Bomba en situación 2)

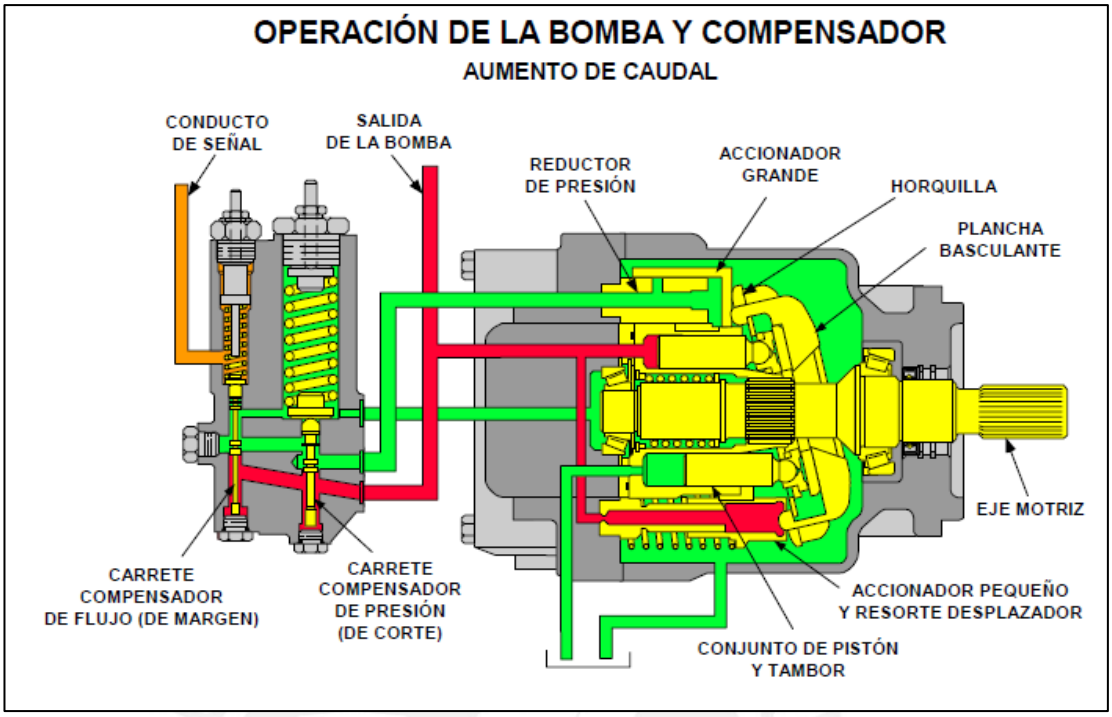


Figura 3.3. Bomba en situación 3)

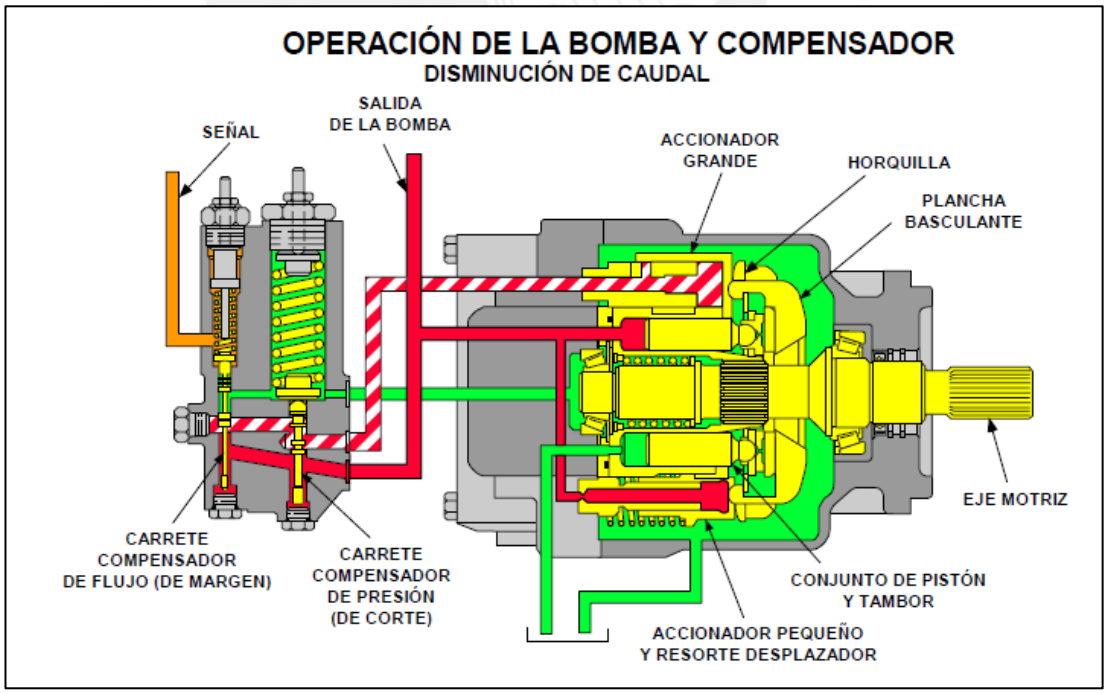


Figura 3.4. Bomba en situación 4)

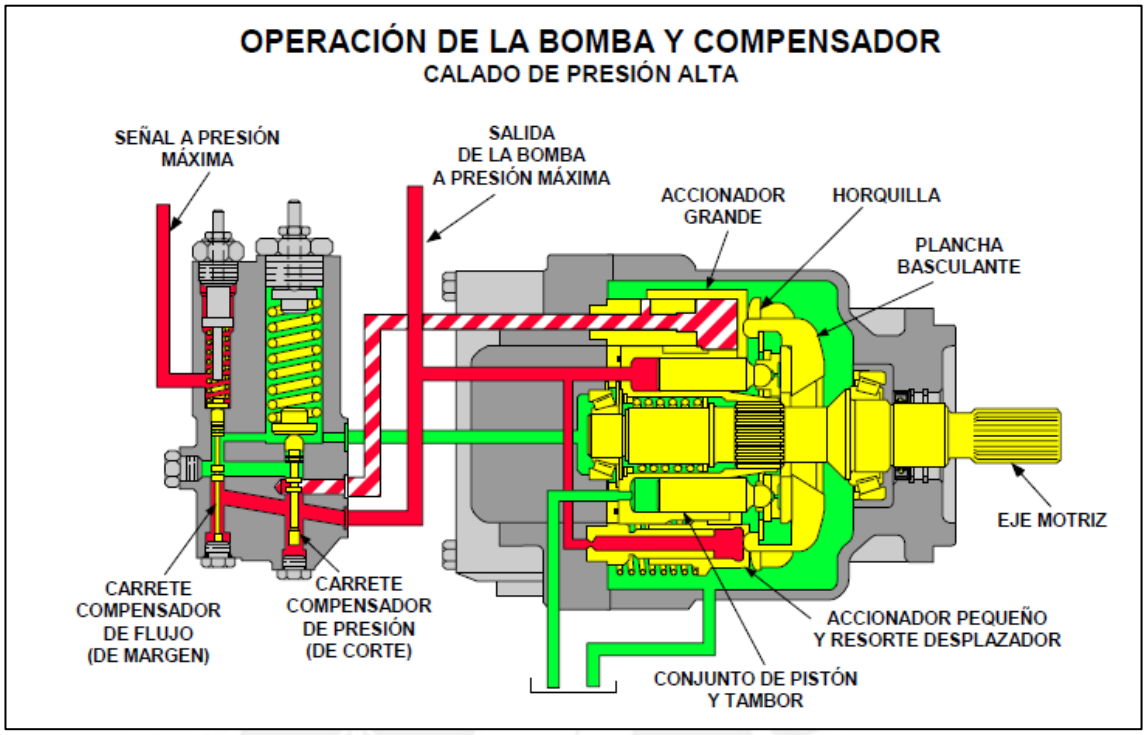


Figura 3.5. Bomba en situación 5)

ANEXO 4. Catálogos

Bomba de transmisión hidrostática AA4VG

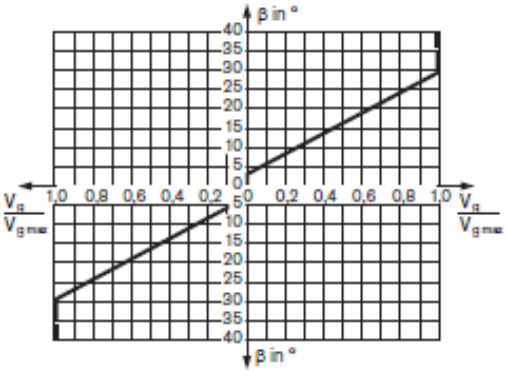
El modelo de bomba escogida fue el de control manual para su plato basculante (HW).

HW - Hydraulic Control, Mechanical Servo

The flow output of the pump is infinitely varied in the range of 0 to 100%, proportional to the rotation of the control lever between 0° and ±29° from the spring centered zero flow position.

A feedback lever, connected to the stroking piston, maintains the pump flow for any given position of the control lever between 0° and 29°.

If the pump is also equipped with a DA control valve (see page 17), automotive operation is possible for travel drives.



Swivel angle β at the control lever for deflection:

Start of control at β = 3°

End of control at β = 29° (max. displacement $V_{g\,max}$)

Mech. stop: sizes 28...71 ±40°
sizes 90...250 ±35°

The maximum required torque at the lever is 15 lb-in (170 Ncm). To prevent damage to the HW control module a positive mechanical stop must be provided for the HW control linkage.

Note:
Spring centering enables the pump to move automatically into neutral position ($V_g = 0$) as soon as there is no longer any torque on the control lever of the HW control unit (regardless of deflection angle).

Variation: Neutral position switch, L

The switch contact in the neutral position switch is closed when the control lever on the HW control unit is in its neutral position. The switch opens if the control lever is moved out of neutral in either direction.

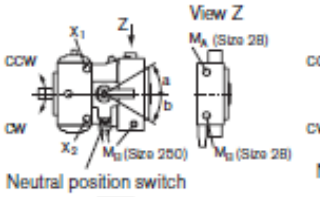
The neutral position switch provides a safety function for drive units that require zero flow under certain operating conditions (e.g. starting diesel engines).

Technical data of neutral position switch	
Load capacity	20 A (continuous), without switching operating
Switching capacity	15 A / 32 V (ohm's load)
	4 A / 32 V (inductive load)
Connector version	DEUTSCH connector DT04-2P-EP04 (mating connector see page 60)

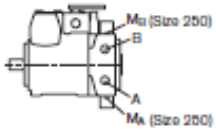
Assignment
Direction of rotation - Control - Direction of through put flow

Direction of rotation	Size	Lever direction	Control pressure	Through put flow	Operating pressure
cw	28...56	a	X_2	B to A	M_A
		b	X_1	A to B	M_B
	71...250	a	X_2	A to B	M_B
		b	X_1	B to A	M_A
ccw	28...56	a	X_2	A to B	M_B
		b	X_1	B to A	M_A
	71...250	a	X_2	B to A	M_A
		b	X_1	A to B	M_B

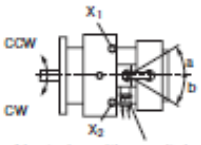
Sizes 28, 250



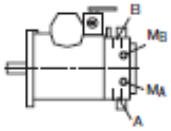
Neutral position switch



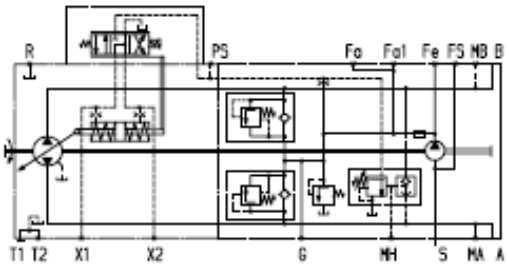
Sizes 40...180



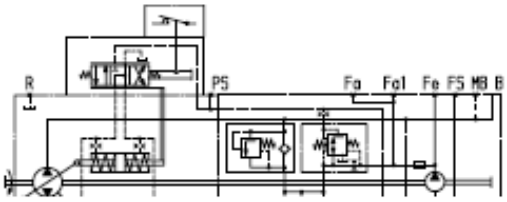
Neutral position switch



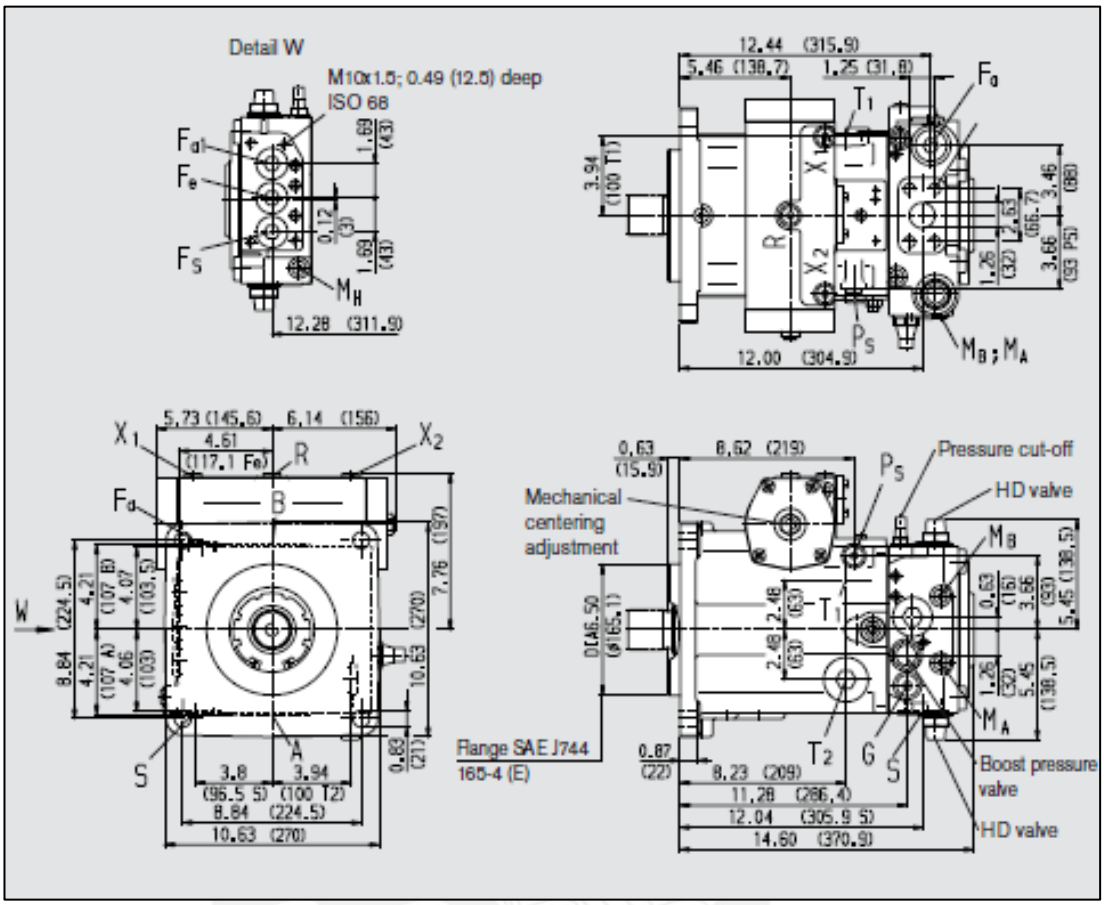
Standard version [1]



Version with DA control valve and neutral position switch [1]



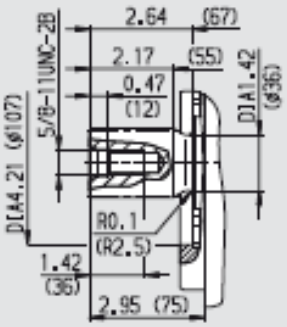
[1]) Size 28 and 250 without port F_{o1} and F_S



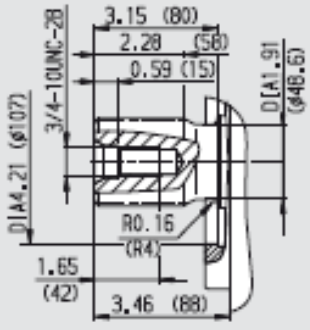
Unit Dimensions, Size 180

Shaft ends

S Splined shaft 1 3/4in
13T 8/16DP [1])
(SAE J744 – 44-4 (D))

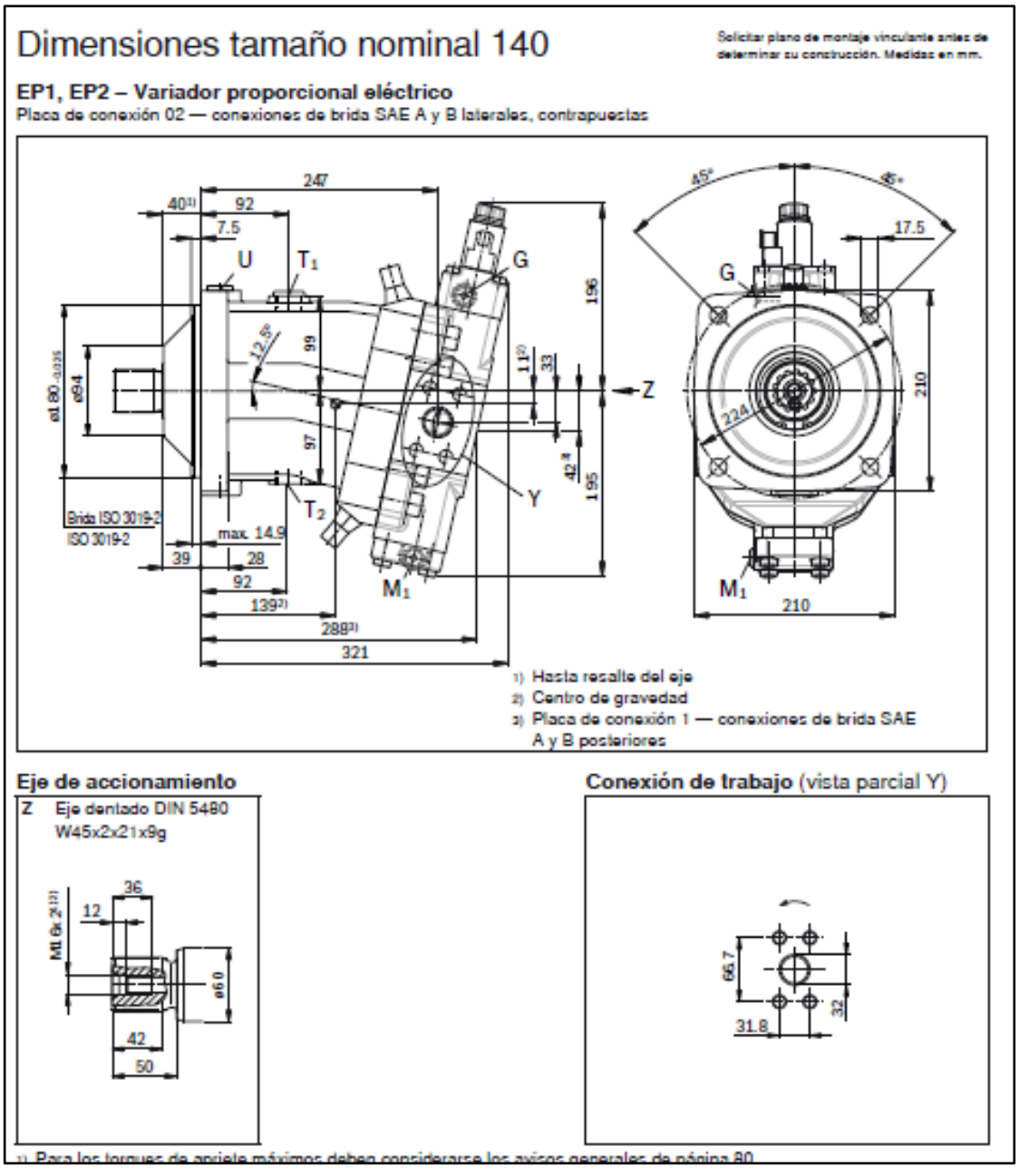


T Splined shaft 2 1/4 in
17T 8/16DP [1])



Motor de transmisión hidrostática A6VM

El motor hidráulico escogido tiene las siguientes dimensiones:



Válvula check CXJA Sun hydraulics

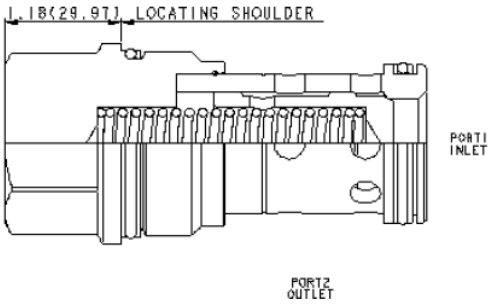
sun hydraulics

MODEL CXJA

Free flow nose to side check valve

SERIES 4 / CAPACITY: 160 gpm / CAVITY: T-18A

snhy.com/CXJA



CONFIGURATION

X	Control	Not Adjustable
C	Cracking Pressure	30 psi (2 bar)
N	Seal Material	Buna-N
(none)	Material/Coating	Standard Material/Coating

Free-flow, nose-to-side check valves are on/off circuit components that allow free flow from the inlet (port 1) to the outlet (port 2) and block flow in the opposite direction.

TECHNICAL DATA

Maximum Operating Pressure	5000 psi
Maximum Valve Leakage at 110 SUS (24 cSt)	1 drops/min.
Seal Kits - Cartridge	Buna: 990-018-007
Seal Kits - Cartridge	EPDM: 990-018-014
Seal Kits - Cartridge	Polyurethane: 990-018-002
Seal Kits - Cartridge	Viton: 990-018-006

CONFIGURATION OPTIONS **Model code example: CXJAXCN**

CONTROL		CRACKING PRESSURE		SEAL MATERIAL		MATERIAL/COATING	
X	**Not Adjustable**	**C**	**30 psi (2 bar)**	**N**	**Buna-N**	**(none)**	**Standard Material/Coating**
		A	4 psi (0,3 bar)	E	EPDM	/AP	Stainless Steel, Passivated
		B	15 psi (1 bar)	V	Viton	/LH	Mild Steel, Zinc-Nickel
		D	50 psi (3,5 bar)				
		E	75 psi (5 bar)				
		F	100 psi (7 bar)				
		G	150 psi (10,5 bar)				

Válvula 2/2 DLDM Sun hydraulics

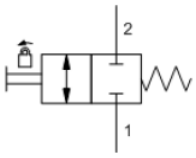
sun hydraulics

MODEL DLDM

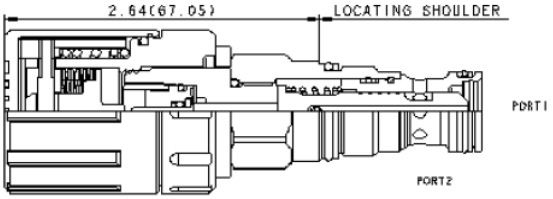
2-way, manually-operated, directional spool valve

SERIES 1 / CAPACITY: 12 gpm / CAVITY: T-13A

snhy.com/DLDM



L-Control, C-Spool



CONFIGURATION

L	Control	Twist/Lock (Detent) Manual Override
C	Spool Configuration	Normally Closed
N	Seal Material	Buna-N

This manually operated, 2-position, 2-way directional cartridge is a direct-acting, balanced spool valve used to control the direction of flow in a hydraulic circuit. The valve is available in either a normally open or normally closed configuration. Manual operation is achieved via Sun's Twist/Lock manual override mechanism and is designed for intermittent (infrequent) use only.

TECHNICAL DATA

Maximum Operating Pressure	5000 psi
Maximum Valve Leakage at 110 SUS (24 cSt)	5 in³/min.@3000 psi
Operating Torque	10 lbf in.
Seal Kits - Cartridge	Buna: 990-413-007
Seal Kits - Cartridge	Polyurethane: 990-413-002
Seal Kits - Cartridge	Viton: 990-413-006

CONFIGURATION OPTIONS **Model code example: DLDMLCN**

CONTROL		SPOOL CONFIGURATION		SEAL MATERIAL	
L	**Twist/Lock (Detent) Manual Override**	**C**	**Normally Closed**	**N**	**Buna-N**
D	Twist/Lock (Dual) Manual Override	H	Normally Open	V	Viton
T	Twist (Momentary) Manual Override				

Válvula reguladora de presión LPJC Sun hydraulics

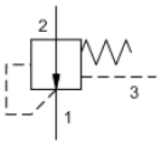
sun hydraulics

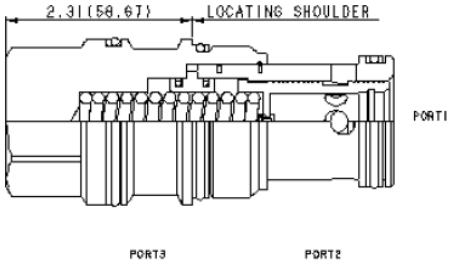
MODEL LPJC

Normally open, modulating element

SERIES 4 / CAPACITY: 120 gpm / CAVITY: T-19A

snhy.com/LPJC





CONFIGURATION

X	Control	Not Adjustable
D	Differential Pressure	50 psi (3,5 bar)
N	Seal Material	Buna-N
(none)	Material/Coating	Standard Material/Coating

Normally open modulating elements without an internal orifice act as a restrictive compensator to maintain a constant pressure drop across an orifice, regardless of variations in upstream or downstream pressure.

TECHNICAL DATA

Maximum Operating Pressure	5000 psi
Seal Kits - Cartridge	Buna: 990-019-007
Seal Kits - Cartridge	Viton: 990-019-006
Seal Kits - Cartridge	Polyurethane: 990-019-002

CONFIGURATION OPTIONS **Model code example: LPJCXDN**

CONTROL	DIFFERENTIAL PRESSURE	SEAL MATERIAL	MATERIAL/COATING
X Not Adjustable	**D 50 psi (3,5 bar)**	**N Buna-N**	**(none) Standard Material/Coating**
P External 1/4 NPTF Pilot Port, Port 3 Blocked	H 200 psi (14 bar)	V Viton	/AP Stainless Steel, Passivated
	F 100 psi (7 bar)		
	G 150 psi (10,5 bar)		

Válvula estranguladora de caudal NFED Sun hydraulics

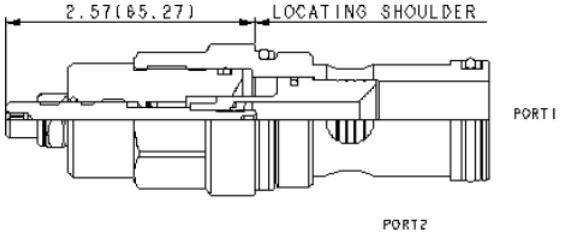
sun hydraulics

MODEL NFED

Fully adjustable needle valve

SERIES 3 / CAPACITY: 90 gpm (.69 inch) / CAVITY: T-16A

snhy.com/NFED



CONFIGURATION

L	Control	Standard Screw Adjustment
H	Maximum Orifice Diameter	.69 in. (17,5 mm)
N	Seal Material	Buna-N
(none)	Material/Coating	Standard Material/Coating

Needle valves are fully adjustable orifices used to regulate flow. They are infinitely adjustable from fully closed up to the maximum orifice diameter. They are not pressure-compensated. They may be used as flow controls or as shutoff valves.

TECHNICAL DATA

Adjustment - Number of Counterclockwise Turns - Fully Closed to Fully Open	5
Maximum Operating Pressure	5000 psi
Locknut Hex Size	9/16 in.
Locknut Torque	80 - 90 lbf in.
Seal Kits - Cartridge	Buna: 990-016-007
Seal Kits - Cartridge	Polyurethane: 990-016-002
Seal Kits - Cartridge	EPDM: 990-016-014
Seal Kits - Cartridge	Viton: 990-016-006

CONFIGURATION OPTIONS **Model code example: NFEDLHN**

CONTROL	MAXIMUM ORIFICE DIAMETER	SEAL MATERIAL	MATERIAL/COATING
L Standard Screw Adjustment	**H .69 in. (17,5 mm)**	**N Buna-N**	**(none) Standard Material/Coating**
H Calibrated Handknob with Detent Lock		E EPDM	/AP Stainless Steel, Passivated
K Handknob		V Viton	/LH Mild Steel, Zinc-Nickel
Y Tri-Grip Handknob			

Válvula limitadora de presión pilotada RPIC Sun hydraulics

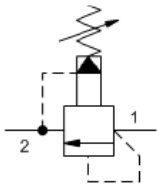
sun hydraulics

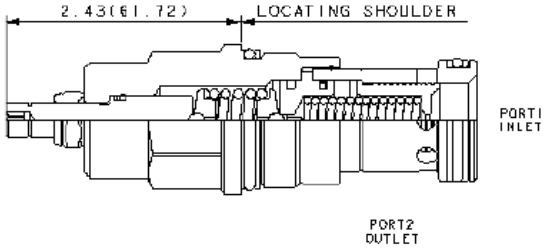
MODEL RPIC

Pilot operated, balanced piston relief valve

SERIES 3 / CAPACITY: 100 gpm / CAVITY: T-16A

snhy.com/RPIC





CONFIGURATION

L	Control	Standard Screw Adjustment
C	Adjustment Range	150 - 6000 psi (10,5 - 420 bar), 1000 psi (70 bar) Standard Setting
N	Seal Material	Buna-N
(none)	Material/Coating	Standard Material/Coating

Pilot-operated, balanced-piston relief cartridges are normally closed pressure regulating valves. When the pressure at the inlet (port 1) reaches the valve setting, the valve starts to open to tank (port 2), throttling flow to regulate the pressure. These valves are accurate, have low pressure rise vs. flow, they are smooth and quiet, and are moderately fast.

TECHNICAL DATA

Factory Pressure Settings Established at	4 gpm
Maximum Operating Pressure	5000 psi
Maximum Valve Leakage at 110 SUS (24 cSt)	4 in³/min.@1000 psi
Response Time - Typical	10 ms
Adjustment - Number of Clockwise Turns to Increase Setting	5
Locknut Hex Size	9/16 in.
Locknut Torque	80 - 90 lbf in.
Seal Kits - Cartridge	Buna: 990-016-007
Seal Kits - Cartridge	EPDM: 990-016-014
Seal Kits - Cartridge	Viton: 990-016-006
Seal Kits - Cartridge	Polyurethane: 990-016-002

CONFIGURATION OPTIONS

Model code example: RPICLCN

CONTROL

L	**Standard Screw Adjustment**
C	Tamper Resistant - Factory Set
W	Hex Wrench Adjustment
Y	Tri-Grip Handknob

ADJUSTMENT RANGE

C	**150 - 6000 psi (10,5 - 420 bar), 1000 psi (70 bar) Standard Setting**
A	100 - 3000 psi (7 - 210 bar), 1000 psi (70 bar) Standard Setting
W	150 - 4500 psi (10,5 - 315 bar), 1000 psi (70 bar) Standard Setting
B	50 - 1500 psi (3,5 - 105 bar), 1000 psi (70 bar) Standard Setting
D	25 - 800 psi (1,7 - 55 bar), 400 psi (28 bar) Standard Setting
E	25 - 400 psi (1,7 - 28 bar), 200 psi (14 bar) Standard Setting
N	60 - 800 psi (4 - 55 bar), 400 psi (28 bar) Standard Setting
Q	60 - 400 psi (4 - 28 bar), 200 psi (14 bar) Standard Setting

SEAL MATERIAL

N	**Buna-N**
E	EPDM
V	Viton

MATERIAL/COATING

(none)	**Standard Material/Coating**
/AP	Stainless Steel, Passivated
/LH	Mild Steel, Zinc-Nickel

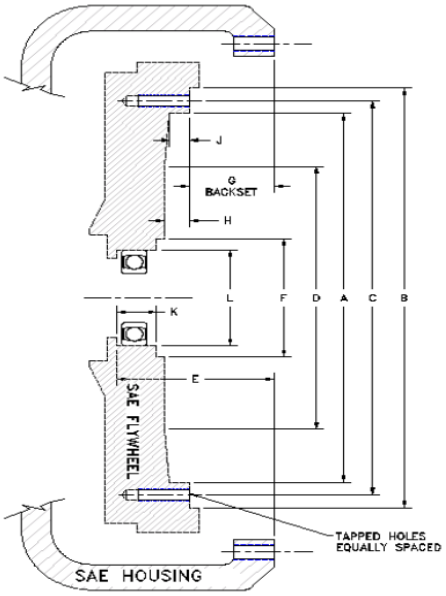
ANEXO 5. Normas

Norma de volantes SAE J620

Flywheels - SAE J620

Flywheel#	A	B	C	D	E	F
6-1/2	7.25	8.500	7.875	5.00	2.81	2.50
7-1/2	8.12	9.500	8.750	--	2.81	2.50
8	8.88	10.375	9.625	--	3.94	3.00
10	10.88	12.375	11.625	7.75	3.94	3.00
11-1/2	12.38	13.875	13.125	8.00	3.94	--
14	16.12	18.375	17.250	8.75	3.94	4.00

Flywheel#	G	H	J	K	L	Tapped Holes	
						No	Size
6-1/2	1.19	0.50	0.38	0.69	2.0472	6	5/16-18
7-1/2	1.19	0.50	0.50	0.69	2.0472	8	5/16-18
8	2.44	0.50	0.50	0.75	2.4409	6	3/8-16
10	2.12	0.62	0.50	1.12	2.8346	8	3/8-16
11-1/2	1.56	1.12	0.88	1.25	2.8346	8	3/8-16
14	1.00	1.12	0.88	1.50	3.1496	8	1/2-13



Norma de mangueras hidráulicas SAE J517

TABLE 1—SUMMARY OF SAE J517 100R-SERIES HOSE MAXIMUM OPERATING PRESSURE MPa / PSI

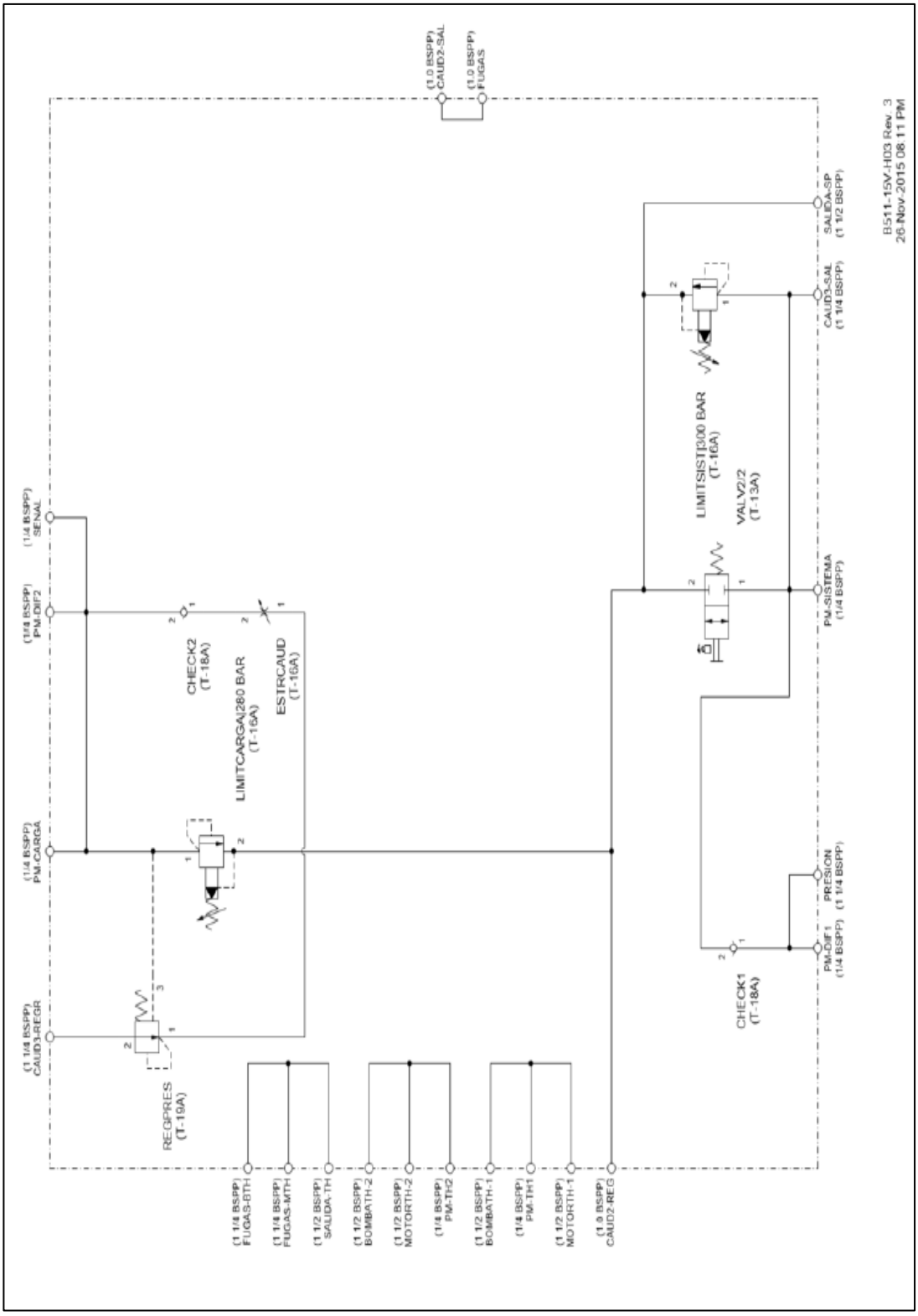
Nominal Hose I.D. Size, in	100R1	100R2	100R3	100R4	100R5	100R6	100R7	100R8	100R9	100R10	100R11	100R12	100R13	100R14
1/8														10.3 / 1500
3/16	20.7 / 3000	34.5 / 5000	10.3 / 1500		20.7 / 3000	3.4 / 500	20.7 / 3000	34.5 / 5000		68.9 / 10000	86.2 / 12500			10.3 / 1500
1/4	19.0 / 2750	34.5 / 5000	8.6 / 1250		20.7 / 3000	2.8 / 400	19.0 / 2750	34.5 / 5000		60.3 / 8750	77.6 / 11250			10.3 / 1500
5/16	17.2 / 2500	29.3 / 4250	8.3 / 1200		15.5 / 2250	2.8 / 400	17.2 / 2500							10.3 / 1500
3/8	15.5 / 2250	27.6 / 4000	7.8 / 1125			2.8 / 400	15.5 / 2250	27.6 / 4000	31.0 / 4500	51.7 / 7500	68.9 / 10000	27.6 / 4000		10.3 / 1500
13/32	15.5 / 2250				13.8 / 2000									6.9 / 1000
1/2	13.8 / 2000	24.1 / 3500	6.9 / 1000		12.1 / 1750	2.8 / 400	13.8 / 2000	24.1 / 3500	27.6 / 4000	43.1 / 6250	51.7 / 7500	27.6 / 4000		5.5 / 800
5/8	10.3 / 1500	19.0 / 2750	6.0 / 875		10.3 / 1500	2.4 / 350	10.3 / 1500	19.0 / 2750				27.6 / 4000		5.5 / 800
3/4	8.6 / 1250	15.5 / 2250	5.2 / 750	2.1 / 300		2.1 / 300	8.6 / 1250	15.5 / 2250	20.7 / 3000	34.5 / 5000	43.1 / 6250	27.6 / 4000	34.5 / 5000	5.5 / 800
7/8	7.8 / 1125	13.8 / 2000			5.5 / 800									5.5 / 800
1	6.9 / 1000	13.8 / 2000	3.9 / 565	1.7 / 250			6.9 / 1000	13.8 / 2000	20.7 / 3000	27.6 / 4000	34.5 / 5000	27.6 / 4000	34.5 / 5000	5.5 / 800
1-1/8					4.3 / 625									4.1 / 600
1-1/4	4.3 / 625	11.2 / 1625	2.6 / 375	1.4 / 200					17.2 / 2500	20.7 / 3000	24.1 / 3500	20.7 / 3000	34.5 / 5000	
1-3/8					3.4 / 500									
1-1/2	3.4 / 500	8.6 / 1250		1.0 / 150					13.8 / 2000	17.2 / 2500	20.7 / 3000	17.2 / 2500	34.5 / 5000	
1-13/16					2.4 / 350									
2	2.6 / 375	7.8 / 1125		0.7 / 100					13.8 / 2000	17.2 / 2500	20.7 / 3000	17.2 / 2500	34.5 / 5000	
2-3/8					2.4 / 350									
2-1/2		6.9 / 1000		0.4 / 62							17.2 / 2500			
3				0.4 / 56	1.4 / 200									
4				0.2 / 35										

ANEXO 6. Lista de adaptadores y conectores

	Tipo	Denominación	De:	A:
Bomba de prueba	Conector codo 90°	Presión	Brida SAE J518 1 1/4"	Manguera 1 1/2"
	Conector		Manguera 1 1/2"	Hembra rosca JIC 37° 1 7/8"
	Conector codo 90°	Succión	Brida SAE J518 2 1/2"	Manguera 3"
	Conector		Manguera 3"	Hembra rosca JIC 37° 2 1/2"
	Adaptador	Fugas	Macho rosca 1 1/16 -12 UNF-2B	Macho rosca JIC 37° 1 1/16"
	Conector		Hembra rosca JIC 37° 1 1/16"	Manguera 1"
	Conector		Manguera 1"	Hembra rosca JIC 37° 1 1/16"
	Adaptador	Señal	Macho rosca 7/16 -20 UNF-2B	Macho rosca JIC 37° 7/16"
	Conector		Hembra rosca JIC 37° 7/16"	Manguera 1/4"
	Conector		Manguera 1/4"	Hembra rosca JIC 37° 7/16"
Panel de interacción	Adaptador	Presión	Macho rosca JIC 37° 1 7/8"	Macho rosca JIC 37° 1 7/8"
	Conector		Hembra rosca JIC 37° 1 7/8"	Manguera 1 1/2"
	Conector		Manguera 1 1/2"	Hembra rosca JIC 37° 1 7/8"
	Adaptador	Succión	Macho rosca JIC 37° 2 1/2"	Macho rosca JIC 37° 2 1/2"
	Conector		Hembra rosca JIC 37° 2 1/2"	Manguera 3"
	Conector		Manguera 3"	Hembra rosca JIC 37° 2 1/2"
	Adaptador	Fugas	Macho rosca JIC 37° 1 1/16"	Macho rosca JIC 37° 1 1/16"
	Conector		Hembra rosca JIC 37° 1 1/16"	Manguera 1"
	Conector		Manguera 1"	Hembra rosca JIC 37° 1 1/16"
	Adaptador	Señal	Macho rosca JIC 37° 7/16"	Macho rosca JIC 37° 7/16"
	Conector		Hembra rosca JIC 37° 7/16"	Manguera 1/4"
	Conector		Manguera 1/4"	Hembra rosca JIC 37° 7/16"
Bloque de válvulas	Adaptador	Entrada	Macho rosca G 1 1/4	Macho rosca JIC 37° 1 7/8"
	Adaptador	Manometro 1	Macho rosca G 1/4	Macho rosca G 1/4
	Conector		Hembra rosca G 1/4	Manguera 1/4"
	Conector		Manguera 1/4"	Hembra rosca G 1/4
	Adaptador	Manometro 2	Macho rosca G 1/4	Macho rosca G 1/4
	Conector		Hembra rosca G 1/4	Manguera 1/4"
	Conector		Manguera 1/4"	Hembra rosca G 1/4
	Adaptador	Caudalímetro 3 (salida)	Macho rosca G 1 1/4	Macho rosca JIC 37° 1 5/8"
	Conector		Hembra rosca JIC 37° 1 5/8"	Manguera 1 1/2"
	Conector		Manguera 1 1/2"	Hembra rosca JIC 37° 1 5/8"
	Adaptador		Macho rosca JIC 37° 1 5/8"	Macho rodca G 1 1/4
	Adaptador	Caudalímetro 3(regreso)	Macho rosca G 1 1/4	Macho rosca JIC 37° 1 5/8"
	Conector		Hembra rosca JIC 37° 1 5/8"	Manguera 1 1/2"
	Conector		Manguera 1 1/2"	Hembra rosca JIC 37° 1 5/8"
	Adaptador		Macho rosca JIC 37° 1 5/8"	Macho rosca G 1 1/4
	Adaptador	Manometro 3	Macho rosca G 1/4	Macho rosca G 1/4
	Conector		Hembra rosca G 1/4	Manguera 1/4"
	Conector		Manguera 1/4"	Hembra rosca G 1/4
	Adaptador	Señal	Macho rosca G 1/4	Macho rosca JIC 37° 7/16"
	Adaptador	Salida	Macho rosca G 1 1/4	Macho rosca JIC 37° 1 5/8"
	Conector		Hembra rosca JIC 37° 1 5/8"	Manguera 2"
	Conector		Manguera 2"	Hembra rosca JIC 37° 1 5/8"
Unión de retorno	Adaptador T	Fugas y Salida	Macho rosca JIC 37° 1 1/16"	Macho rosca JIC 37° 2 1/2"
			Macho rosca JIC 37° 1 5/8"	
	Conector	Salida a filtro	Hembra rosca JIC 37° 2 1/2"	Manguera 3"
	Conector		Manguera 3"	Hembra rosca JIC 37° 2 1/2"
	Conector		Macho rosca JIC 37° 2 1/2"	Macho rosca G 1 1/2
Instrumentación	Conector	Caudalímetro 1 (succión y conexión con filtro)	Hembra rosca JIC 37° 1 7/8"	Manguera 3"
	Conector		Manguera 3"	Hembra rosca JIC 37° 1 7/8"
	Adaptador		Macho rosca JIC 37° 1 7/8"	Macho G 1 1/4
	Adaptador		Macho G 1 1/4	Macho rosca JIC 37° 1 7/8"
	Adaptador	Caudalímetro 2 (fugas)	Macho rosca JIC 37° 1 1/16"	Macho G 1 1/4
	Adaptador		Macho G 1 1/4	Macho rosca JIC 37° 1 1/16"
	Conector		Hembra rosca JIC 37° 1 1/16"	Manguera 1"
	Conector		Manguera 1"	Hembra rosca JIC 37° 1 1/16"

ANEXO 7. Bloque de válvulas

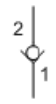
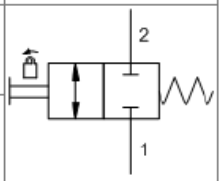
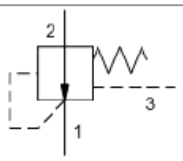
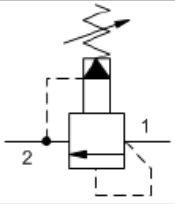
Diagrama interno del bloque



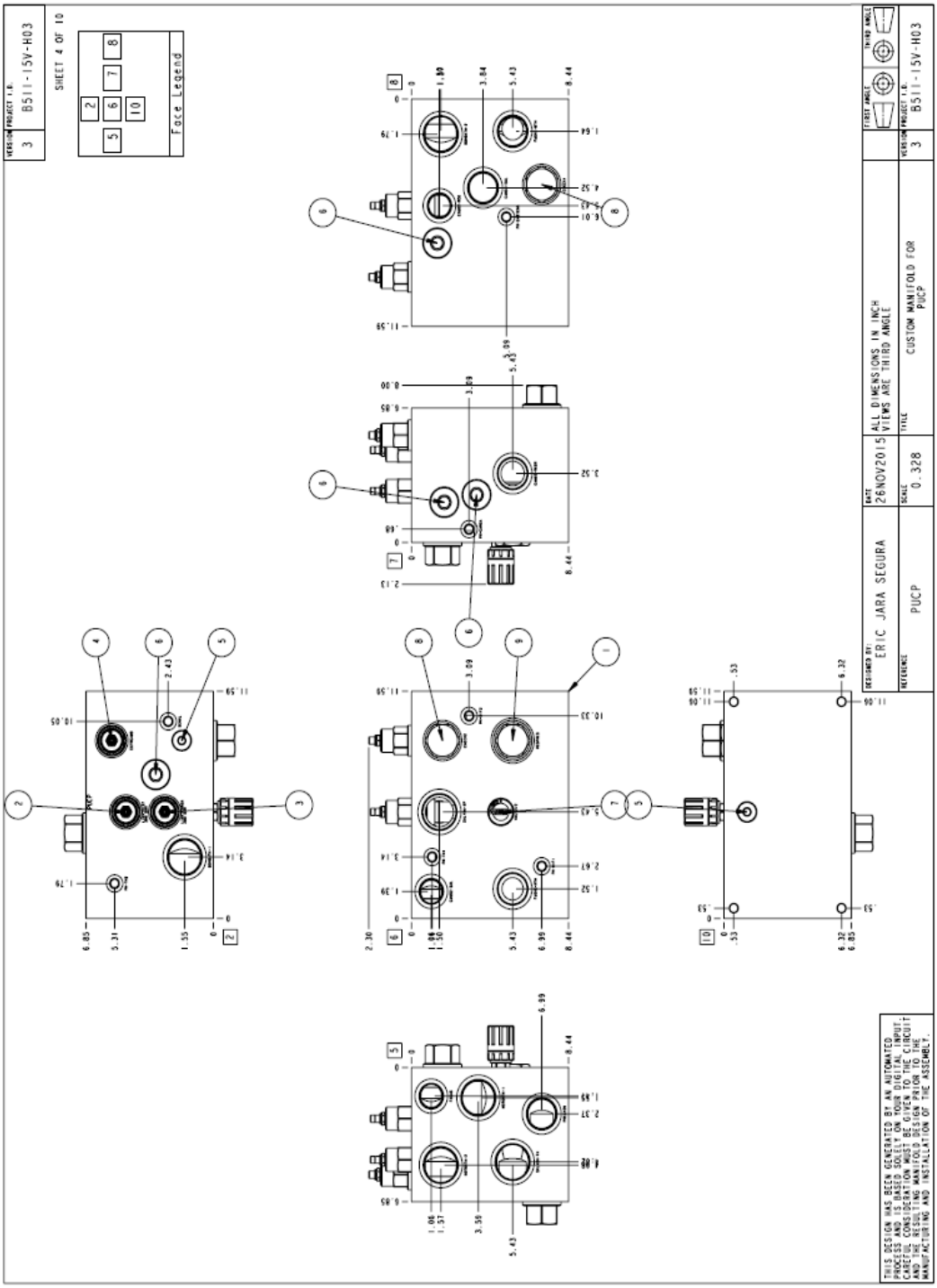
Interconexión de puertos internos

Connection Grid B511-15V-H03-QD3 26-NOV-2015 9:14PM

Ports		Segments A	B	C	D	E	F	G	H	I	J	K	Sizes
BOMBATH-1										I			1 1/2 BSPP
BOMBATH-2											J		
MOTORTH-1										I			
MOTORTH-2											J		
SALIDA-SP								G					
SALIDA-TH												K	
CAUD3-REGR				C									1 1/4 BSPP
CAUD3-SAL			B										
FUGAS-BTH												K	
FUGAS-MTH												K	
PRESION		A											
CAUD2-REG								G					1.0 BSPP
CAUD2-SAL									H				
FUGAS									H				
PM-CARGA							F						1/4 BSPP
PM-DIF1		A											
PM-DIF2							F						
PM-SISTEMA			B										
PM-TH1										I			
PM-TH2											J		
SENAL							F						

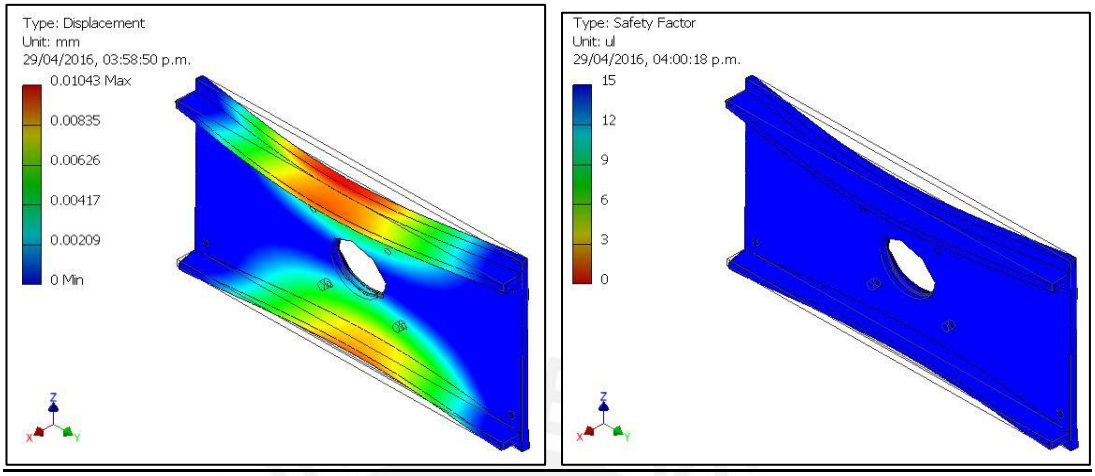
Cartridges	Port												Symbols
CHECK1 T-18A	1	A											
	2		B										
CHECK2 T-18A	1					E							
	2						F						
VALV2/2 T-13A	1		B										
	2							G					
REGPRES T-19A	1				D								
	2			C									
	3						F						
ESTRCAUD T-16A	1				D								
	2					E							
LIMITCARGA 280 BAR T-16A	1						F						
	2							G					
LIMITSIST 300 BAR T-16A	1		B										
	2							G					

Vistas del bloque de válvulas

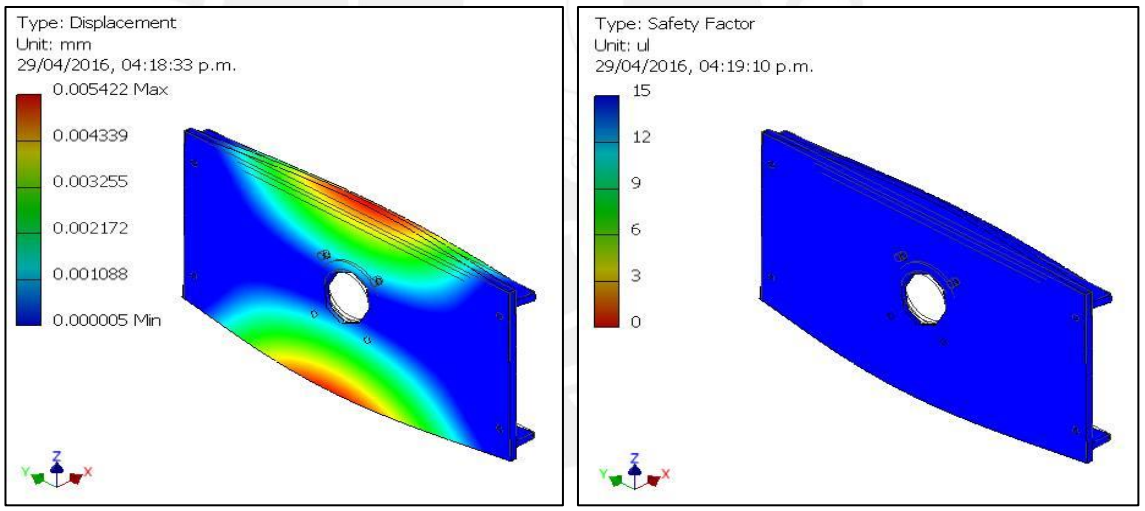


ANEXO 8. Simulaciones en Autodesk Inventor

Análisis estructural de soporte de bomba de transmisión hidrostática



Análisis estructural de soporte de motor de transmisión hidrostática



Diagramas de fuerzas viga principal AS/TB

Los diagramas muestran el punto B por el lado izquierdo hasta el punto T por el lado derecho, además las nomenclaturas siguen a los ejes mostrados en la figura 8.1.

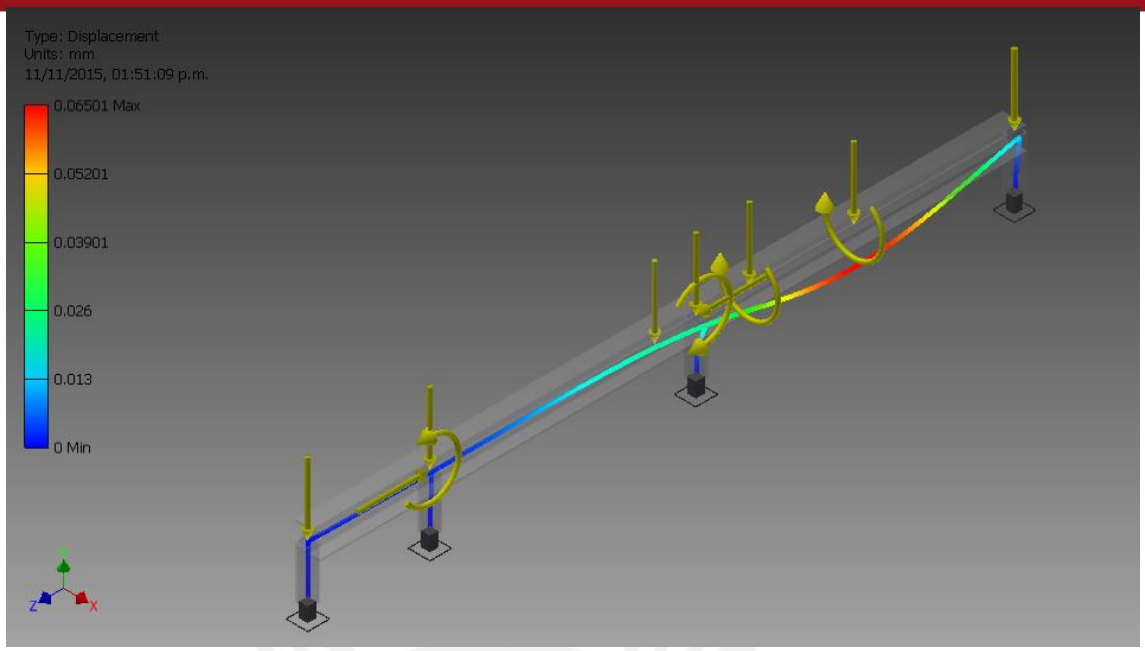


Figura 8.1. Deformación en la viga AS/TB

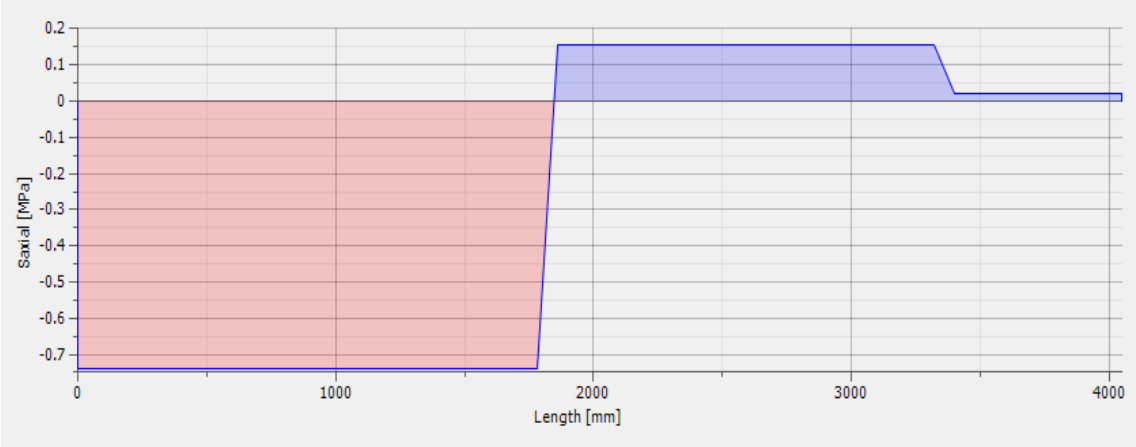


Figura 8.2. Diagrama de esfuerzo normal

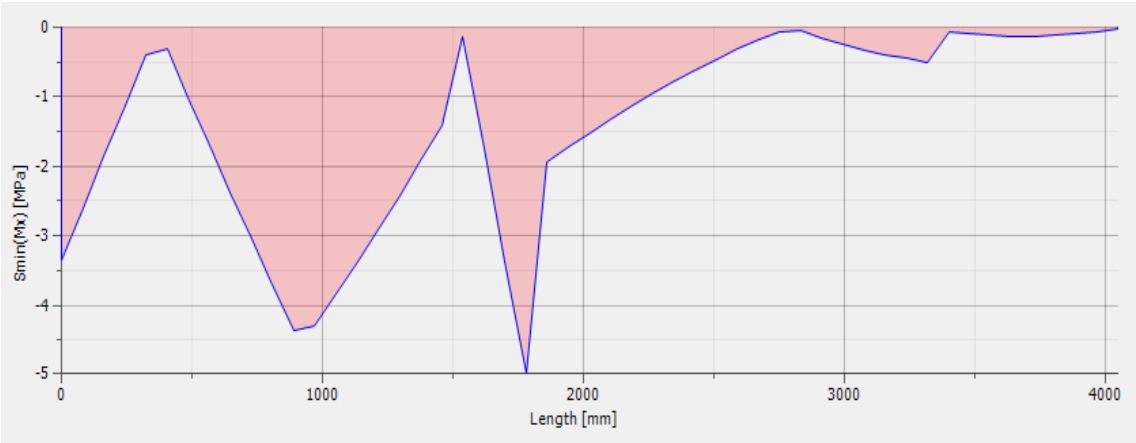


Figura 8.3. Diagrama de esfuerzo flector normal

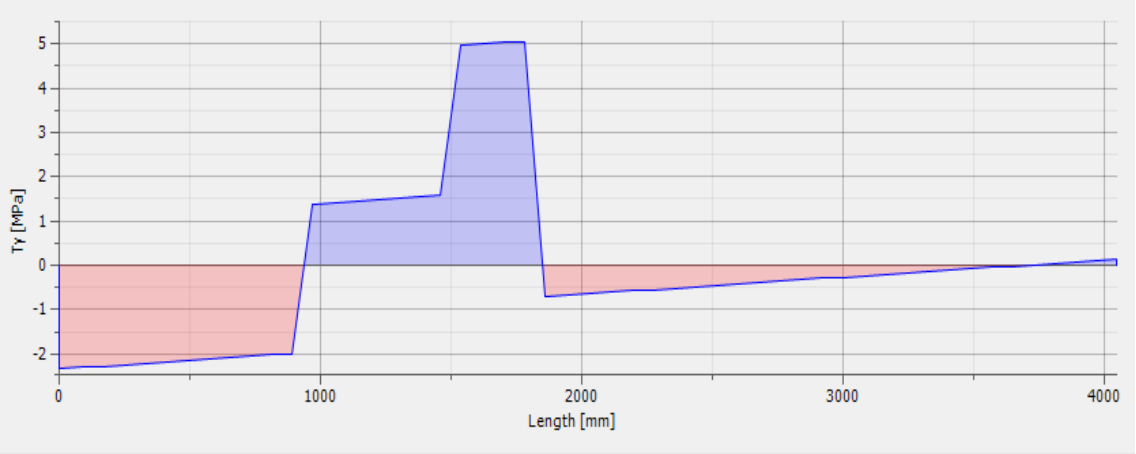


Figura 8.4. Diagrama de esfuerzo cortante

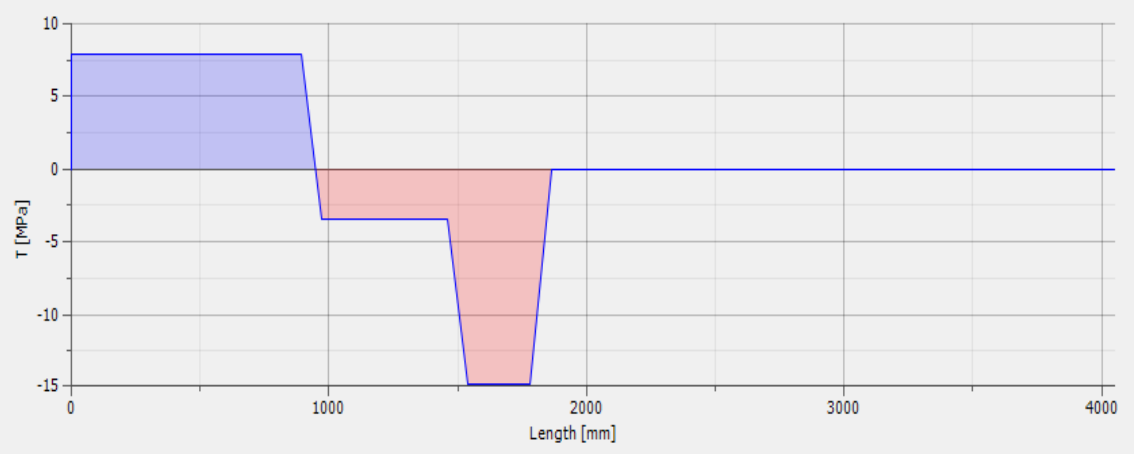


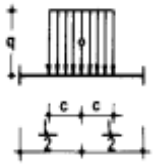
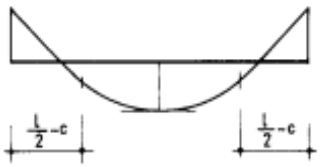
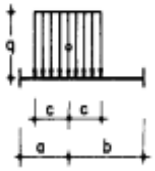
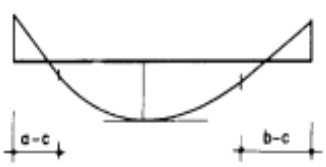
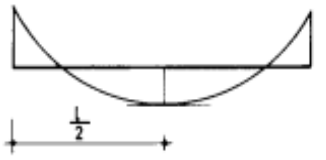
Figura 8.5. Diagrama de esfuerzo torsor

ANEXO 9. Formulario de momentos y reacciones en vigas

VIGA EMPOTRADA

DISTINTAS HIPOTESIS DE CARGA

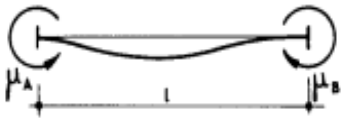
F, q y segmentos, en valor absoluto.

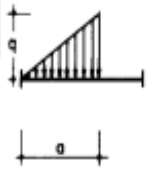
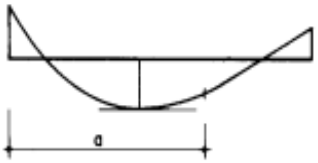
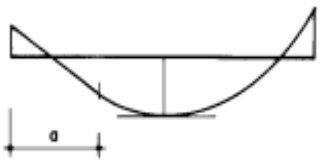
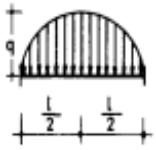
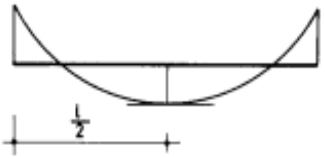
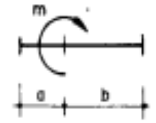
SOLICITACION	MOMENTOS DE EMPOTRAMIENTO PERFECTO	REACCIONES EN LOS APOYOS	DIAGRAMA DE MOMENTOS FLECTORES
	$\mu_A = \frac{qc}{12l}(3l^2-4c^2)$ $\mu_B = -\frac{qc}{12l}(3l^2-4c^2)$	$R_A = qc$ $R_B = qc$	
	$\mu_A = 2qc\left(a\frac{b^2}{l^2} - \frac{c^2}{l^2}\frac{3b-l}{3}\right)$ $\mu_B = -2qc\left(b\frac{a^2}{l^2} - \frac{c^2}{l^2}\frac{3a-l}{3}\right)$	$R_A = 2qc\left[1-3\frac{a^2}{l^2}\frac{c^2}{l^2}+2\frac{a}{l}\left(\frac{a^2}{l^2}+\frac{c^2}{l^2}\right)\right]$ $R_B = 2qc\left[3\frac{a^2}{l^2}+\frac{c^2}{l^2}-2\frac{a}{l}\left(\frac{a^2}{l^2}+\frac{c^2}{l^2}\right)\right]$	
	$\mu_A = \frac{5}{96}ql^2$ $\mu_B = -\frac{5}{96}ql^2$	$R_A = \frac{ql}{4}$ $R_B = \frac{ql}{4}$	
	$\mu_A = \frac{ql^2}{30}$ $\mu_B = -\frac{ql^2}{20}$	$R_A = \frac{3}{20}ql$ $R_B = \frac{7}{20}ql$	

VIGA EMPOTRADA

DISTINTAS HIPOTESIS DE CARGA

F, q y segmentos, en valor absoluto.



SOLICITACION	MOMENTOS DE EMPOTRAMIENTO PERFECTO	REACCIONES EN LOS APOYOS	DIAGRAMA DE MOMENTOS FLECTORES
	$\mu_A = \frac{q a^2}{30}\left[10 - \frac{a}{l}\left(15 - 6\frac{a}{l}\right)\right]$ $\mu_B = -\frac{q a^3}{20 l}\left(5 - 4\frac{a}{l}\right)$	$R_A = \frac{q a}{20}\left[10 - \frac{a^2}{l^2}\left(15 - 8\frac{a}{l}\right)\right]$ $R_B = \frac{q a^3}{20 l^2}\left(15 - 8\frac{a}{l}\right)$	
	$\mu_A = \frac{q b^3}{60 l}\left(5 - 3\frac{b}{l}\right)$ $\mu_B = -\frac{q b^2}{60}\left[3\frac{b^2}{l^2} + 10\frac{a}{l}\right]$	$R_A = \frac{q b^3}{20 l^2}\left(5 - \frac{2b}{l}\right)$ $R_B = \frac{q b}{20}\left[10 - \frac{b^2}{l^2}\left(5 - 2\frac{b}{l}\right)\right]$	
carga parabólica 	$\mu_A = \frac{q l^2}{15}$ $\mu_B = -\frac{q l^2}{15}$	$R_A = \frac{q l}{3}$ $R_B = \frac{q l}{3}$	
	$\mu_A = m\frac{b}{l}\left(2 - 3\frac{b}{l}\right)$ $\mu_B = m\frac{a}{l}\left(2 - 3\frac{a}{l}\right)$	$R_A = m\frac{6ab}{l^3}$ $R_B = -m\frac{6ab}{l^3}$