MORIS
lifting up, make it safe

Chapter 3

PISTON SELECTION

Moris Italia s.r.l.
Via Per Cadrezzate, 21/C
21020 Brebbia (VA) - Italy
Tel. ++39 0332 984211 - Fax ++39 0332 984280
e-mail moris@moris.it
www.moris.it

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DRAWING	DESCRIPTION
9019/1	Calculation methods for buckling force applied to rod (UNI-EN 81.20/50)
9019/2	Symbols and notes for buckling force to be calculated
9020/1	Table for checking the max. loads ram from Dia 50 to Dia 100 (European standard EN 81.20/50)
9030/1-1	Table for checking the max. loads rams from Dia 110 to Dia 130 (European standard EN 81.20/50)
9030/1-2	Table for checking the max. loads rams from Dia 150 to Dia 238 (European standard EN 81.20/50)
9040	Geometric characteristics for rod to be calculated
9041/1	Beginning data and max. pressures calculated for cylinder (and feed pipe) checking
9041/2	Drawing for cylinder calculation procedure
9041/3/4/5/6/7	Cylinder calculation procedure
9041/S	Initial data for cylinder – piston group (Harmonised standards UNI 81.20/50)
9130	Indirect side acting 2:1 ram
9131/MCE-MCS	Indirect side acting 2:1 ram for elevator platform
9140	Direct side acting 1:1 ram
9150	Direct underground 1:1 ram
9180/10	HL jack type Compact
9315	Side ram
9180/1	Cabin lowering due to compressibility oil
9180/2	Calculating compressibility oil jack Ø50-Ø100
9180/3	Calculating compressibility oil jack Ø110-Ø200
9330/AT	Protection rod system for transport

1) METHOD OF EULERO CASE 2 (COEFF. OF SAFETY 2)

-GRAPHICS DWG. 9020/1 – 9030/1-1 – 9030/1-2

IT'S THE SYSTEM OF CALCULATION REQUIRED BY **UNI-EN 81.20/50** HARMONIZED FOR **λ ≥ 100**

1.1 $$Fs <= \frac{\pi^2 E J}{2 l^2}$$

PER $\lambda < 100$

1.2 $$Fs <= \frac{A}{2}\left[Rm - (Rm - 210) \times (\lambda/100)^2\right]$$

1.3 $$F_S = 1.4 g_n \left[C_m (P_3 + Q) + 0.64 P_r + P_m\right]$$

IN MARKED GRAPHICS IS SHOWED THE TOTAL FORCE APPLIED TO RAM **W** THEREFORE:

1.4 $$W = C_m (P_3 + Q) + P_{rh}$$

2) IMPORTANT FORMULAS

$$J = \frac{\pi}{64}\left[d^4 - (d - 2e)^4\right] \quad [mm^4]$$

$$\lambda = \frac{l}{i}$$

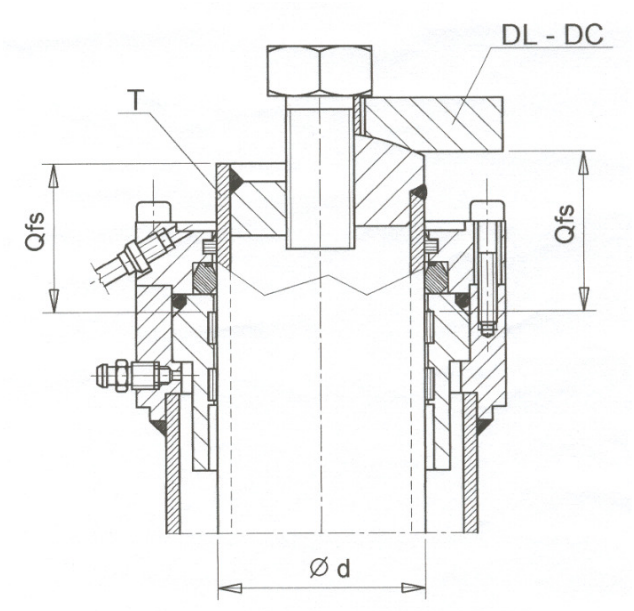
$$J = \frac{\pi}{64}\left[d^2 - (d - 2e)^2\right] \quad [mm^2]$$

$$P_r = \gamma l$$

$$i\sqrt{\frac{J}{A}} \quad [mm]$$

$$A_p = \frac{d\pi}{4} \quad [mm^2]$$

3) **Qfs** VALUE TO CALCULATE THE LENGHT OF THE STEM'S FREE FLEXURE (REGISTERED IN DIAGRAMS: 9020/1 - 9030/1-1 – 9030/1-2) WITH THE HIGHEST VALUE **" DL – DC "**



ϕ d ROD (mm)	Qfs T (mm)	Qfs DL-DC (mm)
50 /100	74.5	84.5
110 / 150	81.5	91.5
160 / 238	90	95

UT	**CALCULATION METHODS FOR BUCKLING FORCE APPLIED TO RODS (UNI-EN 81.20/50)**	DATA 03/17
		N.DIS **9019/1**

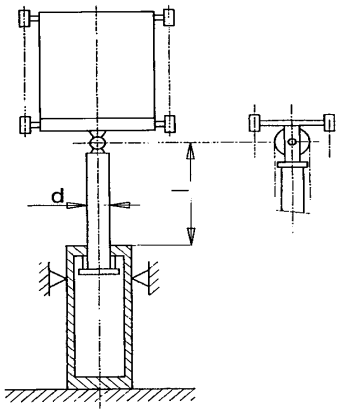
MEASUREMENTS	SYMBOL		UNIT
STRENGHT CROSS-SECTIONAL AREA OF THE RAM	A	.....	mm^2
OUTSIDE DIAMETER OF THE RAM.....	d	.....	mm
THICNESS OF THE RAM	e	.....	mm
OUTSIDE DIAMETER OF THE CYLINDER.....	D	.....	mm
THICKNES OF THE CYLINDER	e_{cyl}	.....	mm
CROSS-SECTIONAL AREA OF THE RAM.....	A_p	.....	mm^2
RADIUS OF GYRATION OF THE RAM	i	.....	mm
SECOND MOMENT OF THE RAM	J	.....	mm^4
MASS FOR UNIT OF LENGTH OF THE RAM.....	γ	.....	Kg/mm
COEFFICIENT OF SLENDERNESS OF THE RAM	λ		
MODULUS OF ELASTICITY (FOR STEEL, E=2.1 10^5)	E	.....	N/mm^2
LENGTH OF THE STEM'S FREE FLEXURE (TOTAL STROKE+Qfs+DISTANCE, IF ANY OF THE PULLEY AXIS AT THE TOP OF THE STEM	l	.....	mm
TENSILE STRENGTH OF MATERIAL	R_m	.....	N/mm^2
ACCELERATION OF GRAVITY	g_n	.....	m/s^2
REEVING RATIO	C_m		
SUM OF THE MASS OF THE EMPTY CAR AND THE MASS OF THE PORTION OF THE TRAVELLING CABLES SUSPENDED FROM THE CAR.....	P_3	.....	Kg
RATED LOAD (MASSE) DISPLAYED IN THE CAR	Q	.....	Kg
MASS OF THE RAM	γ	.....	Kg
MASS OF THE RAM-HEAD EQUIPMENT.....	P_{rh}	.....	Kg
ACTUAL BUCKLING FORCE APPLIED.....	F_S	.....	N
ADMISSIBLE VALUE OF STRENGTH ACCORDING TO DIN 4114 (FOR $S_t 52.0\ \sigma$ d,am=210)	$\sigma_{d,am}$	.....	N/mm^2
COEFFICIENT TO BE CALCULATED FROM DIN 4114 IN FUNCTION OF	ω		
COEFFICIENT OF OVERPRESSURE	1.4		

EXPLANATORY NOTES ON GRAPHICS

1 - THE UPPER AND LOWER LIMIT OF THE CURVE IS CUT BY MAX. AND MIN. VALUES OF THE ADMISSIBLE PRESSURE (RESPECTIVELY 45 AND 12 BAR).

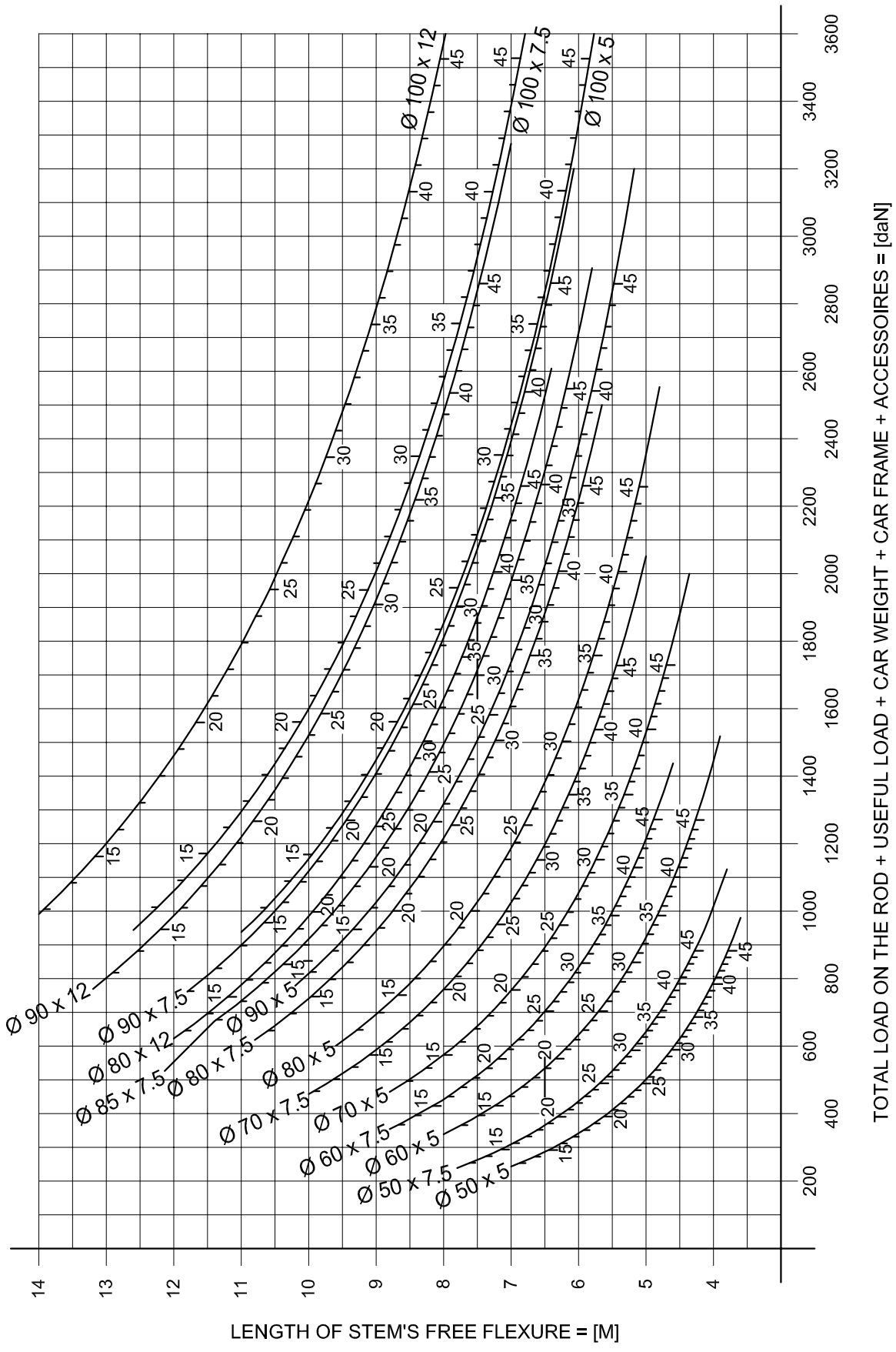
2- REPRESENTED CURVES WERE EXECUTED ACCORDING TO EULERO'S FORMULAS.

- GRAPHICS EXECUTED ACCORDING TO STANDARD EN 81.20/50 FOR VALUES $\lambda < 100$: IN ORDER TO OBTAIN MORE PRECISE VALUES, MUST BE USED THE FORMULA SHOWED AT POINT 1.2 (SEE NOTES ON GRAPHICS)).
- GRAPHICS EXECUTED ACCORDING TO STANDARD TRA 200 FOR $\lambda \leq 250$: IN ORDER TO OBTAIN MORE PRECISE VALUES, MUST BE USED THE FORMULA SHOWED AT POINT 4.1 (SEE NOTES ON GRAPHICS).
- CURVES EXECUTED ACCORDING TO EULERO'S FORMULAS ARE ALWAYS ON THE SIDE OF SAFETY.



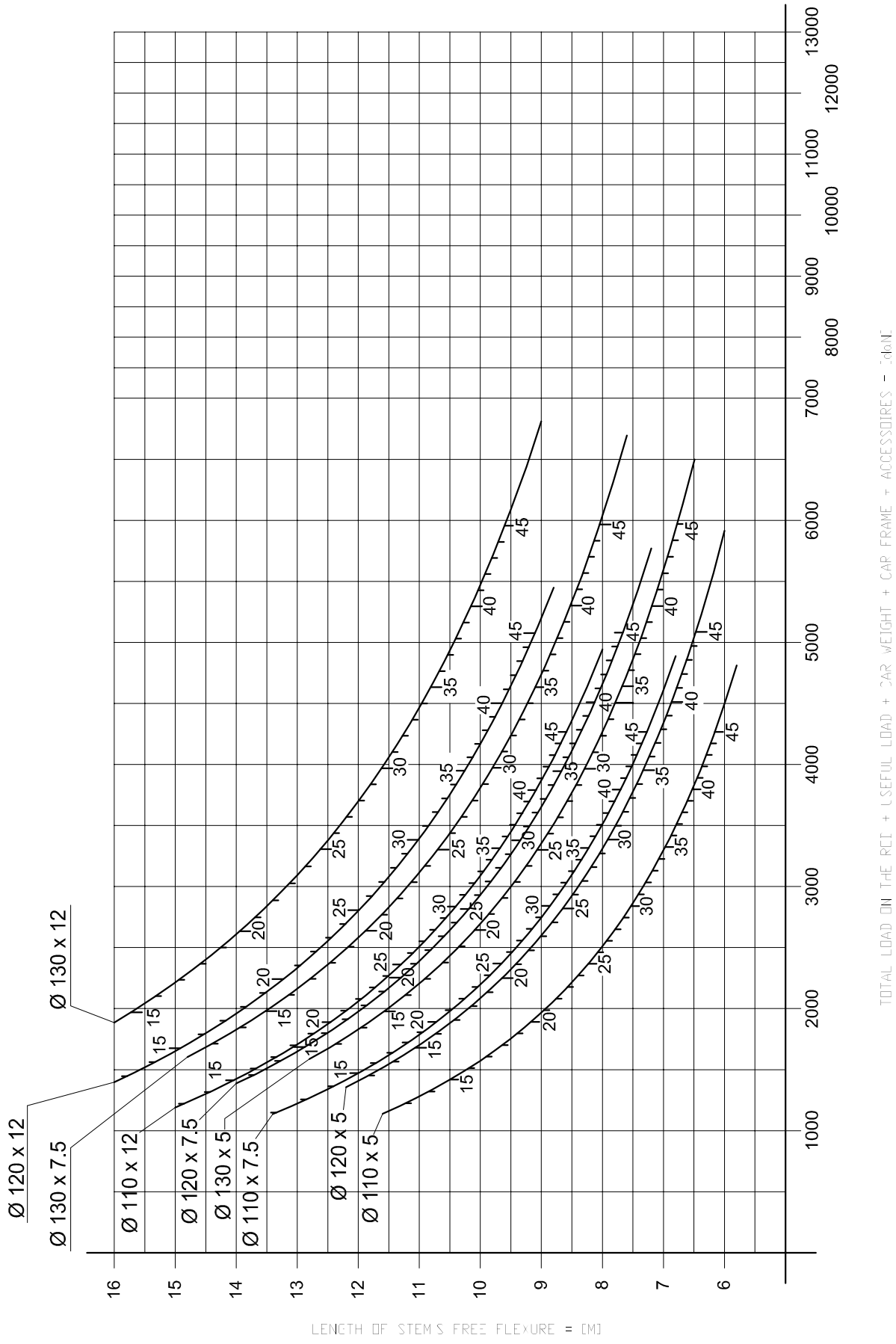
UT			SYMBOLS AND NOTES FOR BUCKLING FORCE TO BE CALCULATED	DATA 03/17
				N.DIS **9019/2**

EULERO'S METHOD CASE 2 (COEFFICIENT OF SAFETY 2)



UT	TABLE FOR CHECKING THE MAX. LOADS FOR RAMS 50 TO 100 (EUROPEAN STANDARD EN 81.20/50)	DATE 03/17
		DWG Nr 9020/1

EULERO'S METHOD CASE 2 (COEFFICIENT OF SAFETY 2)



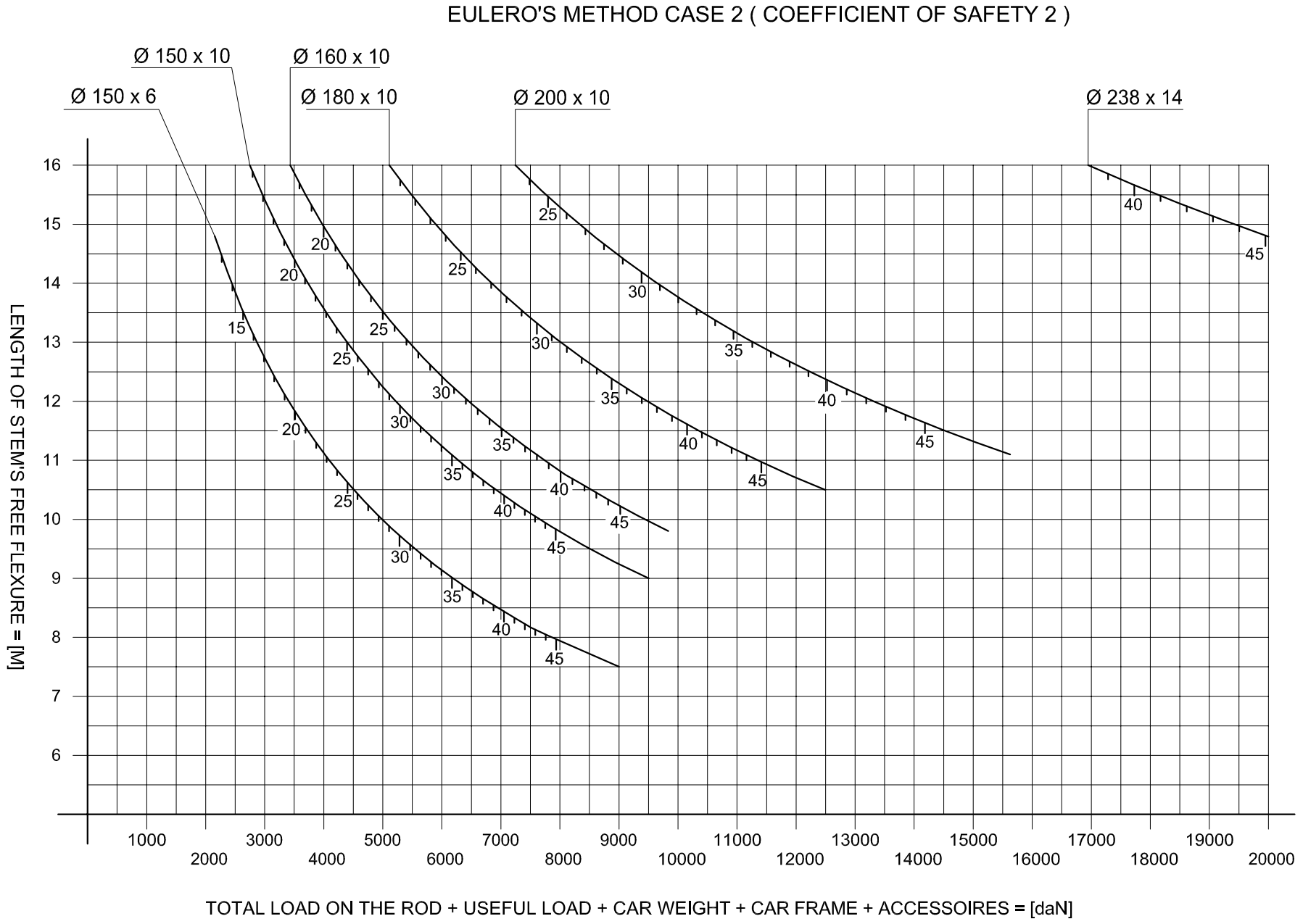
UT			TABLE FOR CHECKING THE MAX. LOADS FOR RAMS Ø 110 A Ø130 (EUROPEAN STANDARD EN 81.20/50)	DATE 03/17
				DWG N° 9030/1-1

9030/1-1 IN

9030/2 IN

TABLE FOR CHECKING THE MAX. LOADS FOR RAMS Ø 150 A Ø238

(EUROPEAN STANDARD EN 81.20/50)



DATE	03/17
DWG N°	9030/1-2

_ THE ROD PIPE IS MADE OF STEEL St52.0 – DIN 1629/DIN 2391

_ THE CYLINDER PIPE IS MADE OF STEEL St52.0 – DIN 1629/DIN 2448

_ THE FEEDING PIPE IS MADE OF STEEL St37.0 – DIN 1629/DIN 2391

ROD								CYLINDER	
ød mm	e mm	A mm²	Ap mm²	i mm	J mm⁴	γ kg/m	CONNECTION WEIGHT kg	øD mm	e cyl mm
50	5.0 7.5	706.9 1001.4	1963.5	16.01 15.26	181132 233134	5.5 7.8	/	101.6	3.6
60	5.0 7.5	863.9 1237.0	2827.4	19.53 18.75	329376 434884	6.7 9.6	/	101.6	3.6
70	5.0 7.5	1021.0 1472.6	3848.5	23.05 22.26	542416 729408	7.9 11.5	5.1 4.2	114.3	4.0
80	5.0 7.5 12.0	1178.1 1708.2 2563.5	5026.5	26.58 25.77 24.41	832031 1134379 1527870	9.2 13.3 20.0	7.3 6.4 4.5	114.3	4.0
85	7.5	1826.1	5674.5	27.53	1383804	14.3	7.3	114.3	4.0
90	5.0 7.5 12.0	1335.2 1943.9 2940.5	6361.7	30.10 29.29 27.90	1210004 1667468 2289203	10.4 15.2 23.0	9.6 8.5 6.5	133.0	4.5
100	5.0 7.5 12.0	1492.3 2179.5 3317.5	7854.0	33.63 32.81 31.40	1688115 2346346 3271077	11.7 17.1 25.9	13.2 11.7 8.7	139.7	4.5
110	5.0 7.5 12.0	1649.3 2415.1 3692.64	9503.3	37.17 36.34 34.92	2278146 3188686 4501764	12.9 18.9 28.9	25.0 14.6 11.9	159.0	5.0
120	5.0 7.5 12.0	1806.4 2650.7 4071.5	11309.7	40.70 39.86 38.42	2991876 4212158 6009540	14.1 20.7 31.8	25.0 22.8 14.9	159.0	5.0
130	5.0 7.5 12.0	1963.5 2886.3 4448.5	13273.2	44.23 43.39 41.93	3841088 5434434 7822679	15.3 22.5 34.7	32.5 30.8 23.1	177.8	5.6
150	6.0 10.0	2714.3 4398.2	17671.5	50.96 49.62	7047774 10830641	21.2 34.4	47.6 42.1	193.7	5.9
160	10.0	4712.4	20106.2	53.15	13312499	36.8	49.0	219.1	8.0
180	10.0	5340.7	25446.9	60.21	19360065	41.7	74.5	244.3	8.0
200	10.0	5969.0	31415.9	67.27	27009843	46.6	106.5	273.0	10.0
238	14.0	9852.0	44488.1	79.35	62033336	76.9	159.0	323.9	12.5

UT		GEOMETRIC CHARACTERISTICS FOR ROOD TO BE CALCULATED	DATE 11/09
			DWG No 9040

9040–ING

9041/1-ING

UT

BEGINNING DATA AND MAX PRESSURES
CALCULATED FOR CYLINDER
(AND FEED PIPE) CHECKING

DATE 12/07

DWG No 9041/1

BEGINNING DATA

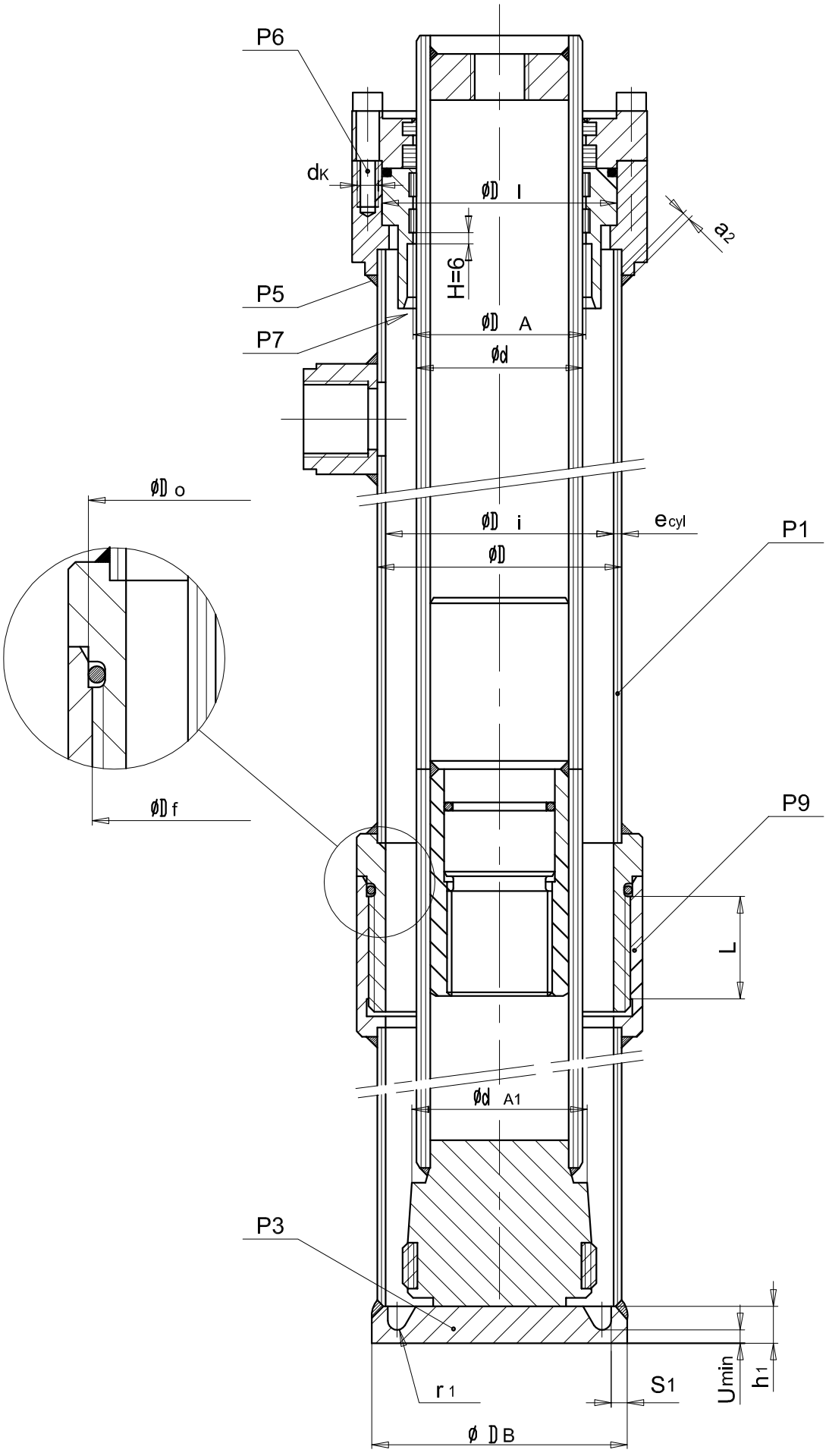
		RAM															FEED PIPE	
OUTSIDE DIAMETER	d	50	60	70	80	85	90	100	110	120	130	150	160	180	200	238	35	42
CYLINDER THICKNESS	e_{cyl}	3.6	3.6	4.0	4.0	4.0	4.5	4.5	5.0	5.0	5.6	5.9	8.0	8.0	10.0	12.5	2.5	3.0
CYLINDER OUTSIDE DIAMETER	D	101.6	101.6	114.3	114.3	114.3	133.0	139.7	159.0	159.0	177.8	193.7	219.1	244.5	273.0	323.9	35	42
CYLINDER BASE THICKNESS	h_1	20.0	20.0	20.0	20.0	20.0	20.0	20.0	28.0	28.0	28.0	28.0	35.0	35.5	35.0	35.0		
CYLINDER INSIDE DIAMETER	Di	94.4	94.4	106.3	106.3	106.3	124.0	130.7	149.0	149.0	166.6	181.9	203.1	228.5	253.0	298.9		
BASE EMBEDDING RADIUS	r_1	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6.0	6.0	6.0	6.0	7.0	7.0	7.0	7.0		
BASE RIM THICKNESS	S1	4.3	4.3	4.9	4.9	4.9	5.5	5.2	6.0	6.0	6.7	7.5	9.5	9.3	11.5	14.6		
RAM HEAD WELDING	a_2	4.0	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0	6.0	7.0	8.0	8.3	10.5	13.0		
SCREWS No OF THE RAM HEAD	n°	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12		
SCREWS DIAMETER		10	10	10	10	10	10	12	12	12	12	14	14	16	18	18		
CONSTANT	C5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
BASE BEARING DIAMETER	d_{A1}	69.3	69.3	79.3	89.3	94.3	99.3	109.3	119.3	129.3	139.3	159.3	174.3	189.3	209.3	247.3		
RAM HEAD EXTRACTING DIAMETER	DA	53.0	63.0	73.0	83.0	88.0	93.0	103.0	113.0	123.0	133.0	153.0	163.3	183.0	203.0	241.0		
RAM HEAD INSIDE DIAMETER	DI	99.0	99.0	107.0	117.0	117.0	127.0	136.0	146.0	155.0	165.0	190.0	197.0	216.0	241.0	278.0		
STRENGTH MATERIAL	$R_{p0.2}$	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
CONNECTION THREAD LENGHT	L	-	-	57	57	57	57	57	54.5	54.5	54.5	54.5	56.5	56.5	56.5	56.5		
THREAD OUTSIDE DIAMETER	Df	-	-	123	123	123	142	151	173	173	186	209	230	257	282	339		
O-RING SEAT DIAMETER	Do	-	-	125.0	125.0	125.0	144.5	153.0	178.0	178.0	191.7	212.7	234.7	261.1	286.1	342.7		
BASE OUTSIDE DIAMETER	DB	103.0	103.0	116.1	116.1	116.1	135.0	141.1	161.0	161.0	180.0	196.1	222.1	247.1	276.0	328.1		

MAX CALCULATED PRESSURES

		RAM															FEED PIPE	
OUTSIDE DIAMETER	d	50	60	70	80	85	90	100	110	120	130	150	160	180	200	238	35	42
CYLINDER PIPE	P1	46.5	46.5	47.7	47.7	47.7	47.8	45.5	45.7	45.7	47.0	45.9	58.0	52.0	59.9	64.5		
CYLINDER BASE	P3	152.2	152.2	120.0	120.0	120.0	88.2	79.4	123.3	123.3	98.7	83.5	105.3	83.2	67.8	48.6		
CYLINDER HEAD WELDING	P5	67.1	67.1	59.6	59.6	59.6	64.1	61.0	53.6	53.6	57.5	61.6	62.2	55.8	62.4	68.4		
CYLINDER HEAD SCREW	P6	93.2	93.2	79.8	66.7	66.7	56.6	81.7	70.9	62.9	55.5	62.5	58.1	67.5	72.2	54.3		
RAM BASE AND CYLINDER HEAD	P7	424.1	177.3	155.9	139.1	132.0	125.5	114.4	105.1	97.1	90.3	79.2	128.2	66.9	60.6	51.4		
FEED LINE PIPE	P8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	68.7	71.6
CALCULATION CYLINDER CONNECTION	P9	-	-	611.3	611.3	611.3	528.1	500.9	405.4	405.4	375.8	343.0	321.4	290.2	265.2	222.2		
REMAINING THICKNESS ON THE BASE	U_{min}	5.2	5.2	6.0	6.0	6.0	6.9	6.9	7.8	7.8	8.9	10.1	12.9	13.1	16.5	16.0		

- THE MAX. WORKING PRESSURE OF EACH CYLINDER IS THE SMALLER AMONG THE INDICATED ONES (IN BAR) ▭

* Fe520 Rp0.2 = 355 N/mm2 YELD TENSION MATERIAL CYLINDRE
Fe370 Rp0.2 = 235 N/mm2 YELD TENSION MATERIAL BASE
Fe370 Rp0.2 = 235 N/mm2 YELD TENSION MATERIAL FEED PIPE
Fe370 Rp0.2 = 98 N/mm2 RESISTANCE TO SHEARING STRESS RAM HEAD



UT		DRAWING FOR CYLINDER CALCULATION PROCEDURE	DATE 02/16
			DWG No 9041/2

9041/2-ING

CYLINDER CALCULATION PROCEDURE

- THE FOLLOWING TECHNICAL DOCUMENTATION IS ABUOT THE CHECKING OF THE CYLINDERS INVOLVED IN LIFTS WORKING.
- CHECKS ARE CARRIED OUT ACCORDING TO STANDARD **TRA 200 (**AND RELATING REFERENCE MARKS) AND HARMONISED STANDARD **UNI-EN 81.20/50.**
- THE MAX ADMISSIBLE STATIC PRESSURE FOR EACH CYLINDER, WHICH COORRESPONDS TO THE MAX. ADMISSIBLE LOAD, IS INDICATED IN THE ENCLOSED TABLE
- FOR EACH PLANT IS INDICATED THE REAL LOAD, WHICH MUST BE ALWAYS SMALLER OR EQUAL TO THE MAX. ADMISSIBLE ONE
- THE CONSIDERED CYLINDER, DEVELOPED BY **MORIS** FACTORY, CORRESPONDS TO DRAWING **0367/2-P**
- MEASUREMENT UNITS GENERALLY USED CORRESPOND TO THE INTERNATIONAL SYSTEM **(S.I.)**
- THE SYMBOLOGY ADOPTED REFERS TO THAT OF STANDARDS **TRA 200** (AND SUBSEQUENT REFERENCES) AND STANDARDS **UNI-EN 81.20/50**

1) CYLINDER PIPE THICKNESS CALCULATION FOR DETERMINING THE INNER PRESSURE

- CALCULATION IS MADE IN COMPLIANCE WITH ANNEX K OF **UNI-EN 81.20/50** STANDARDS AND WITH STANDARD **DIN 2413** APPLICATION FIELD 1
- MATERIAL FEATURES ACCORDING TO **DIN 1629** WITH TESTING CERTIFICATE IN CONFORMITY WITH **DIN 50049-3.1B** (MAX. WORKING PRESSURE 160 bar)
- DIMENSIONS ACCORDING TO **DIN 2448**
- MATERIAL **ST. 52,0 DIN 1629** (1.0421)
- YIELD TENSION ..... $\mathbf{R}_{P0.2} = 355\ N/mm^2$
- BREAKING PERCENTAGE ELONGATION ..... **A5** > 21 %
- FROM **DIN 2413**:

$$e_{cyl} = \frac{D \times P}{20 \times \sigma_{amm} \times \eta_n} + e_o$$ WITH **P** (BAR)

- ACCORDING **TO 200/229.11** **P =** $2{,}3 \times P_{max}$, $e_o = 1$
- FROM **DIN 2413** $\eta_n = 1$ FOR WELDLESS PIPES; $\eta_n = 0{,}8$ FOR WELDED PIPES; $\sigma_{amm} = \frac{R_{p0.2}}{S}$ WITH **S =** 1,7
- REPLACING THE VALUES AND SOLVING WITH RESPECT TO $\mathbf{P_{max}}$:

$$\mathbf{P1_{max}} = \frac{2 \times R_{p0.2} \times (e_{cyl} - 1)}{2.3 \times 1.7 \times D} \times 10$$ WELDLESS PIPES

2) CYLINDER PLANE BASE CALCULATION

- CALCULATION ACCORDING TO TECHNICAL SHEET **AD-MERKBLATT B5, 6.1.1** CASE (E)
- MATERIAL **DIN 17.100 RST 37-2 (1.0038)**

UT			**CYLINDER CALCULATION PROCEDURE**	DATE 03/17
				DWG N **9041/3**

- YIELD TENSION ..... $\mathbf{R}_{P0.2} = 235\ N/mm^2$

$$\mathbf{e}_1 = c \times D_i \times \sqrt{\frac{P \times S}{10 \times R_{P0.2}}} + e_o$$

– ACCORDING TO **TRA 200** $\mathbf{P} = 2{,}3 \times \mathbf{P}_{max}$

$$\mathbf{e}_o = 1$$

– ACCORDING TO **AD-MERKBLATT B0** TABLE 2 **S =** 1,5

– ACCORDING TO **EN 81.20/50** **S =** 1,7

– ACCORDING TO **AD-MERKBLATT B5** TABLE 1 **C =** 0,4

– REPLACING THE VALUES (**S =** 1,7) E RISOLVENDO PER $\mathbf{P}_{max}$:

$$\mathbf{P3}_{max} = \frac{R_{P0.2}}{2.3 \times 1.7} \times \frac{2.5^2 \times (e_1 - 1)^2}{Di^2} \times 10$$

REMANING THICKNESS CALCULATION

– CALCULATION ACCORDING TO **AD-MERKBLATT B5,** TABLE 1, AND ANNEX **K** OF **UNI-EN 81.20/50** STANDARDS.

– CALCULATION OF "**U**min" THICKNESS, WITH PRESSURE **P**, IS <= THAN THE MINIMUM PRESSURE AMONG MAXIMUM ALLOWABLE PRESSURES FOR ALL THE SYSTEM COMPONENTS.

$$\mathbf{U}_{min} = 1.3 \times \frac{(Di \times 0.5 - r_1) \times (2.3 \times 1.7 \times P_{max} \times 0.1)}{R_{P0.2}} + 1$$

MOREOVER, THE FOLLOWING PROJECT CONDITIONS MUST BE VERIFIED:

$\mathbf{U}_{min} >= 5\ mm$

$\mathbf{r}_1 >= 0{,}2 \times S_1$

$\mathbf{r}_1 >= 5\ mm$

$\mathbf{U}_{min} <= 1{,}5 \times S_1$

$\mathbf{h}_1 => u_1 + r_1$

3) CYLINDER PIPE / CYLINDER HEAD WELDING CALCULATION

– MATERIAL **RSt 37-2 DIN 17.100**

$\mathbf{R}_{P0.2} = 98\ N/mm^2$ **(DV 952)**

– WELDING AREA $\mathbf{A} = \pi \times D \times a_2$

– ACTUAL FORCE ON THE WELDING

$$\mathbf{F} = \frac{\pi}{4} \times D^2 \times \frac{2{,}3 \times P_{max}}{10}$$

$$\tau = \frac{F}{A} <= R_{P0.2}$$

– SOLVING WITH RESPECT TO $\mathbf{P}_{max}$ SI HA:

$$\mathbf{P5}_{max} = \frac{R_{P0.2} \times a_2 \times 40}{2.3 \times D}$$

4) CALCULATION OF THE CYLINDER HEAD FIXING SCREW

– CALCULATION ACCORDING TO **AD-MERKBLATT B7**

– SCREWS M…..x …..**UNI 5931 – 8.8**

– ELASTIC LIMIT ACCORDING TO **DIN 267 PAR. 3** $\mathbf{R}_{P0.2} = \mathbf{640\ N/mm^2}$

– ACTUAL FORCE ON THE SCREWS :

$$\mathbf{F} = \frac{2{,}3 \times P_{max} \times \pi \times Dl^2}{40}$$

– MIN. NEEDE BOLT DIAMETER:

$$\mathbf{d}_K = Z \times \sqrt{\frac{F}{R_{P0.2} \times n}} + C5$$

Z = 1,51 FROM **AD-MERKBLATT B7** TABLE 3

n = SCREWS NUMBER

ASSUMING THAT: $Z \times \frac{F}{R_{P0.2} \times n} = Y$

FOR:

Y <= 20 **C5** = 3

Y >= 50 **C5** = 1

20 < Y < 50 $\mathbf{C5} = \frac{(65-Y)}{15}$

– SOLVING WITH RESPECT TO $\mathbf{P}_{max}$:

$$\mathbf{P6}_{max} = \frac{n \times (d_K - C5)^2}{Dl^2} \times 1553{,}85$$

PROJECT CONDITIONS

– SCREWS PITCH NOT MORE THAN 5 x $\mathbf{d}_K$

– MIN. SCREWS NUMBER 4

– MIN.SCREWS DIAMETER M10

– SCREW SHANK LENGTH AT LEAST 2 x $\mathbf{d}_K$

– MIN. ENGAGEMENT DEPTH **L (CLASSE 8.8)**

d / P < 9 L = 1,0 x $\mathbf{d}_K$

d / P > 9 L = 1,25 x $\mathbf{d}_K$

P = THREAD PITCH

5) CALCULATION OF THE LIMIT BEARING PRESSURE BETWEEN RAM BASE AND CYLINDER HEAD

– YELD TENSION RAM BASE:

$$\mathbf{F} = 2{,}3 \times P_{max} \times \frac{\pi}{4} \times d_{A1}^2$$

– REACTION SURFACE:

$$\mathbf{A} = \frac{\pi}{4} \times (d_{A1}^2 - D_A^2)$$

- SOLVING WITH RESPECT TO $\mathbf{P_{max}}$

$$\mathbf{P7}_{max} = \frac{10 \times R_{P0.2} \times \left(d_{A1}{}^2 - D_A{}^2\right)}{d_{A1}{}^2 \times 2.3}$$

6) CALCULATION OF THE FEED LINE PIPES

– CALCULATION ACCORDING TO **DIN 2413,** APPLICATION FIELD 1, AND ANNEX **K** OF **UNI-EN 81.20/50** STANDARDS

– AMTERIAL FEATURES ACCORDING TO **DIN 1629** WITH TESTING CERTIFICATE IN CONFORMITY WITH **DIN 50049-3.1 B** (MAX WORKING PRESSURE **160 bar)**

– DIMENSIONS ACCORDING TO **DIN 2391**

– MATERIAL **St. 37.0 DIN 1629 (1.0254)**

– YIELD TENSION ..... $\mathbf{R}_{P0.2} = 235$ N/mm^2

– BREAKING PERCENTAGE ELONGATION .... **A5 =** 25%

– FROM **DIN 2413** SI HA:

$$\mathbf{e}_{cyl} = \frac{D \times P}{20 \times \sigma_{amm} \times \eta_n} + e_o$$ CON **P** (bar)

- ACCORDING TO **TRA 200/229.11** **P =** 2,3 x P_{max}

e_o = 0,5

- FROM **DIN 2413** **η_n =** 1

$$\sigma_{amm} = \frac{R_{P0.2}}{S}$$ CON **S =** 1,7

- REPLACING THE VALUES AND SOLVING WITH RESPECT TO $\mathbf{P_{max}}$

$$\mathbf{P8}_{max} = \frac{2 \times R_{P0.2} \times \left(e_{cyl} - 0.5\right)}{2.3 \times 1.7 \times Dt} \times 10$$

7) CYLINDER CONNECTION CALCULATION

- THREAD CALCULATION ACCORDING TO TECHNICAL SHEET **AD-MERKBLATT B8 6.13**
- MATERIAL **St. 37.0 DIN 1629 (1.0254)**
- YIELD TENSION..... $\mathbf{R}_{P0.2} = 235$ N/mm^2
- BREAKING PERCENTAGE ELONGATION ..... **A5** = 25%
- WELDINGS CALCULATION ISNT'T NECESSARY; SEE POINT **3** (DRAWING N. 9041/4)

UT			**CYLINDER CALCULATION PROCEDURE**	DATE 03/17
				DWG N **9041/6**

THREAD CALCULATION

- FROM TECHNICAL SHEET **AD-MERKBLATT B8**:

$$\frac{\mathbf{R}_{P0.2}}{\mathbf{S}} = \frac{2 \times F}{L \times \pi \times Df}$$

- WITH:

L = THREAD LENGTH

Df = THREAD DIAMETER

S = SAFETY FACTOR = 1,5

$\mathbf{R}_{P0.2}$ = YIELD TENSION MATERIAL

F = TENSILE FORCE

$$\mathbf{F} = \frac{\pi}{40} \times D_o^2 \times 2{,}3 \times P_{max}$$

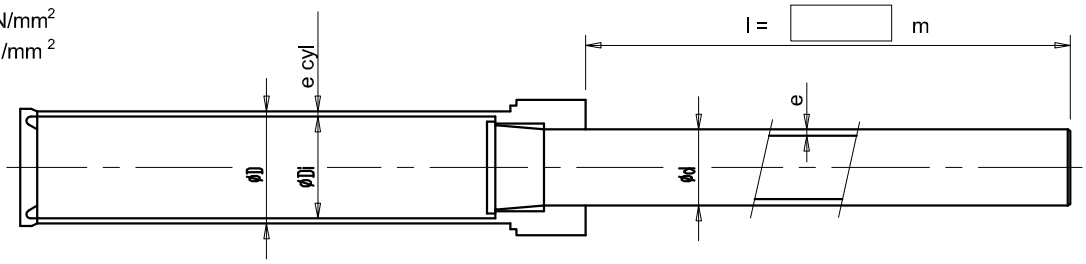
- REPLACING THE VALUES AND SOLVING WITH RESPECT TO $\mathbf{P}_{max}$, SI HA:

$$\mathbf{P9}_{max} = \frac{2 \times R_{P0.2} \times L \times Df}{2.3 \times 1.5 \times D_O^{\,2}} \times 10$$

UT			CYLINDER CALCULATION PROCEDURE	DATE 02/16
				DWG N **9041/7**

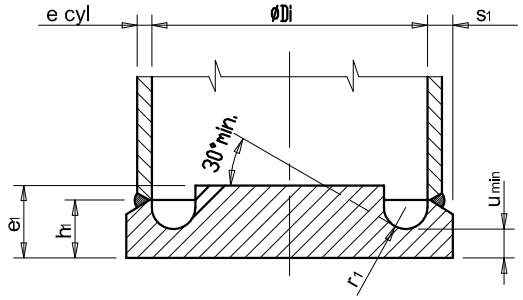
SIMPLE CYLINDER

Rp 0.2 = 355 N/mm^2
Rm = 500 N/mm ^{2}



BOTTON OF CYLINDER

Rp 0.2 = 235 N/mm^2
Rm = 350 N/mm ^{2}



CONDITION FOR EXAUST
OF WELDED COUPLING

r1 ⩾ 0.2 s1 e r1 5 ⩾
Umin ⩽ 1.5 s1
h1 ⩾ Umin + r1

		UNIT	RAM														
d		mm	50	60	70	80	85	90	100	110	120	130	150	160	180	200	238
e cyl		mm	3.6	3.6	4.0	4.0	4.0	4.5	4.5	5.0	5.0	5.6	5.9	8.0	8.0	10.0	12.5
D		mm	101.6	101.6	114.3	114.3	114.3	133.0	139.7	159.0	159.0	177.8	193.7	219.1	244.5	273.0	323.9
e1		mm	20.0	20.0	20.0	20.0	20.0	20.0	20.0	28.0	28.0	28.0	28.0	35.0	35.0	35.0	35.0
D i		mm	94.4	94.4	106.3	106.3	106.3	124.0	130.7	149.0	149.0	166.6	181.9	203.1	228.5	253.0	298.9
r1		mm	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6.0	6.0	6.0	6.0	7.0	7.0	7.0	7.0
S1		mm	4.3	4.3	4.9	4.9	4.9	5.5	5.2	6.0	6.0	6.7	7.5	9.5	9.3	11.5	14.6
h1		mm	20	20	20	20	20	20	20	28	28	28	28	35	35	35	35
Umin		mm	5.2	5.2	6.0	6.0	6.0	6.9	6.9	7.8	7.8	8.9	10.1	12.9	13.1	16.5	16.0
e	5 6 7.5 10 12 14	mm	x x	x x	x x	x x x	x	x x x	x x x	x x x	x x x	x x x	x x	x	x	x	x
Ap		mm^2	1963.5	2827.5	3848.5	5026.5	5674.5	6361.7	7854.0	9503.3	11309.7	13273.2	17671.5	20106.2	25446.9	31415.9	44488.1
A	5 6 7.5 10 12 14	mm^2	706.9 1001.4	863.9 1237.0	1021.0 1472.6	1178.1 1708.2 2563.5	1826.1	1335.2 1943.9 2940.5	1492.3 2179.5 3317.5	1649.3 2415.1 3692.64	1806.4 2650.7 4071.5	1963.5 2886.3 4448.5	2714.3 4398.2	4712.4	5340.7	5969.0	9652.0
i	5 6 7.5 10 12 14	mm	16.01 15.26	19.53 18.75	23.05 22.26	26.58 25.77 24.41	27.53	30.10 29.29 27.90	33.63 32.81 31.40	37.17 36.34 34.92	40.70 39.86 38.42	44.23 43.39 41.93	50.96 49.62	53.15	60.21	67.27	79.35
J	5 6 7.5 10 12 14	mm^4	181132 233134	329376 434884	542416 729408	832031 1134379 1527870	1383804	1210004 1667468 2289203	1688115 2346346 3271077	2278146 3188686 4501764	2991876 4212158 6009540	3841088 5434434 7822679	7047774 10830641	13312499	19360065	27009843	62033336
ϒ	5 6 7.5 10 12 14	Kg/m	5.5 7.8	6.7 9.6	7.9 11.5	9.2 13.3 20.0	14.3	10.4 15.2 23.0	11.7 17.1 25.9	12.9 18.9 28.9	14.1 20.7 31.8	15.3 22.5 34.7	21.2 34.4	36.8	41.7	46.6	76.9

Ap = CROSS-SECTIONAL AREA OF THE RAM
A = STRENGHT CROSS-SECTIONAL AREA OF THE RAM
i = RADIUS OF GYRATION OF THE RAM
J = SECOND MOMENT OF THE RAM
ϒ = MASS OF THE RAM

UT		INITIAL DATA FOR CYLINDER - PISTON GROUP - "HARMONISED STANDARDS UNI EN 81.20/50" -	DATE 03/17 DWG No 9041/S

SEE HYDRAULIC POWER UNIT

A	N18	N19	Q F	ØT	ØG	e cyl	ØD	OIL lxm	1 m Additional	3 m on Stroke	Kit Joints Rod + Cylinder	e	ROD Ød
									WEIGTH Kg				
	M10x45 (50 Nm)	M24x70 Ch=36	200	133	/	3.6	101.6	7	16	64	-	7.5	50
									15	60	-	5	
		M30x60 Ch=46	200	133	/	3.6	101.6	7	19	71	-	7.5	60
									16	64	-	5	
			200	140	133	4	114.3	9	23	84	10	7.5	70
									20	75	11	5	
			200	150	133	4	114.3	9	31	110	10	12	80
									25	91	12	7.5	
									21	79	13	5	
			200	150	133	4	114.3	9	26	94	13	7.5	85
			200	160	155	4.5	133	12	38	134	14	12	90
									30	109	16	7.5	
									26	96	17	5	
	M12x45 (85 Nm)		200	174	166	4.5	139.7	13.5	42	150	18	12	100
									33	122	21	7.5	
									28	107	23	5	
			215	180	190	5	159	17.5	49	175	23	12	110
									39	144	26	7.5	
									33	126	29	5	
			215	190	190	5	159	17.5	52	186	26	12	120
									41	152	34	7.5	
									34	131	37	5	
	M14x55 (135 Nm)		215	202	202	5.6	177.8	22	59	214	36	12	130
									47	175	42	7.5	
									40	153	45	5	
			215	240	228	5.9	193.7	26	63	236	61	10	150
									50	194	66	6	
	M16x65 (205 Nm)	M60 x p. 3.5 L=120 Ch=80	260	242	249	8	219.1	32.5	79	309	70	10	160
			260	270	278	8	244.5	41	90	357	100	10	180
	M18x70 (283 Nm)		260	297	304	10	273	50	113	444	134	10	200

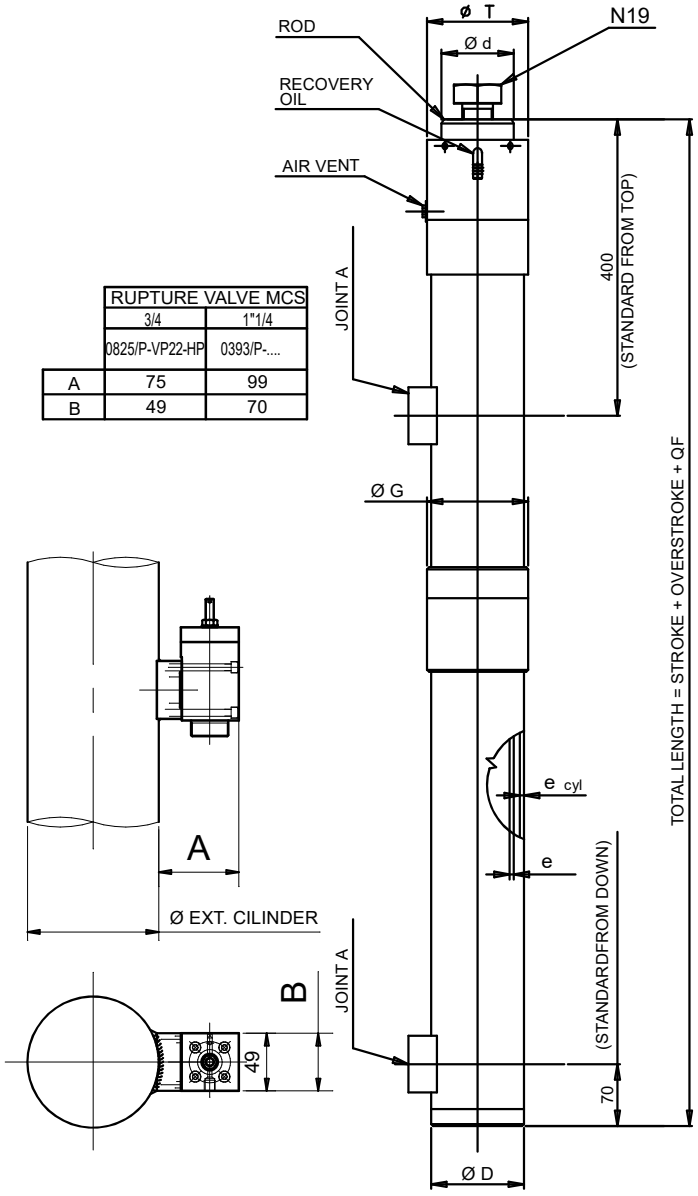
NOTE:
- MORIS ITALIA PRESCRIBES THE ADOPTION OF THE RAM PROTECTION RING,
  FOR SINGLE PIECE RAMS WITH LENGHT GREATER THAN 4,5 m FOR DIAMETERS FROM 70 TO 90 mm,
  FOR SINGLE PIECE RAMS WITH LENGHT GREATER THAN 5 m FOR DIAMETER OF 100 mm,
  FOR SINGLE PIECE RAMS WITH LENGHT GREATER THAN 6 m FOR DIAMETERS FROM 110 TO 200 mm,
  IN ORDER TO AVOID BUMPS AND DEMAGE DURING THE TRANSPORT.
- FOR DIFFERENT HEIGHTSI (> 150 mm) OF JUNCTION "A" FROM THE BOTTOM, SPECIFY IN THE PORDER.
- ROD WITH FRONT SHOCK ABSORBER (ALL OUT) 35 mm.

UT

INDIRECT SIDE RAM

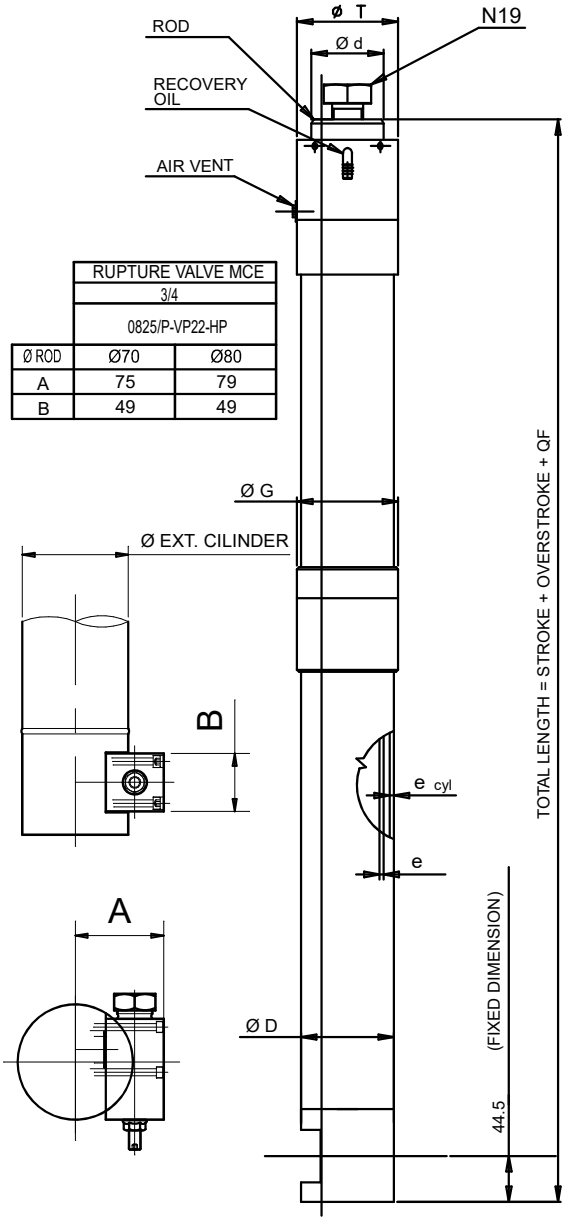
DATE 04/26

DWG Nr 9130



RUPTURE VALVE MCS		
	3/4	1"1/4
	0825/P-VP22-HP	0393/P-....
A	75	99
B	49	70

VERSION 1
(Type: MCS)



RUPTURE VALVE MCE		
	3/4	
	0825/P-VP22-HP	
Ø ROD	Ø70	Ø80
A	75	79
B	49	49

VERSION 2
(Type: MCE)

A	SEE HYDRAULIC POWER UNIT					
N19	T.E. M30x60 Ch. 46 (T.E. M24x70 Ch. 36)					
Q_F VERSION: 2	243		243			
Q_F VERSION: 1	173		173			
ØT	98		110			
ØG	98		113			
e_{cyl}	3.7		3.6			
ØD	90		101.6			
OLIO lxm	5.5		7			
WEIGHT Kg — 1 M ADDITIONAL	17	20	18	22	29	
WEIGHT Kg — 3 M OF STROKE	60	70	65	76	95	
WEIGHT Kg — KIT GASKETS ROD + CYLINDER	9	8	11	10	8	
e	5	7.5	5	7.5	12	
ROD Ød	70		80			

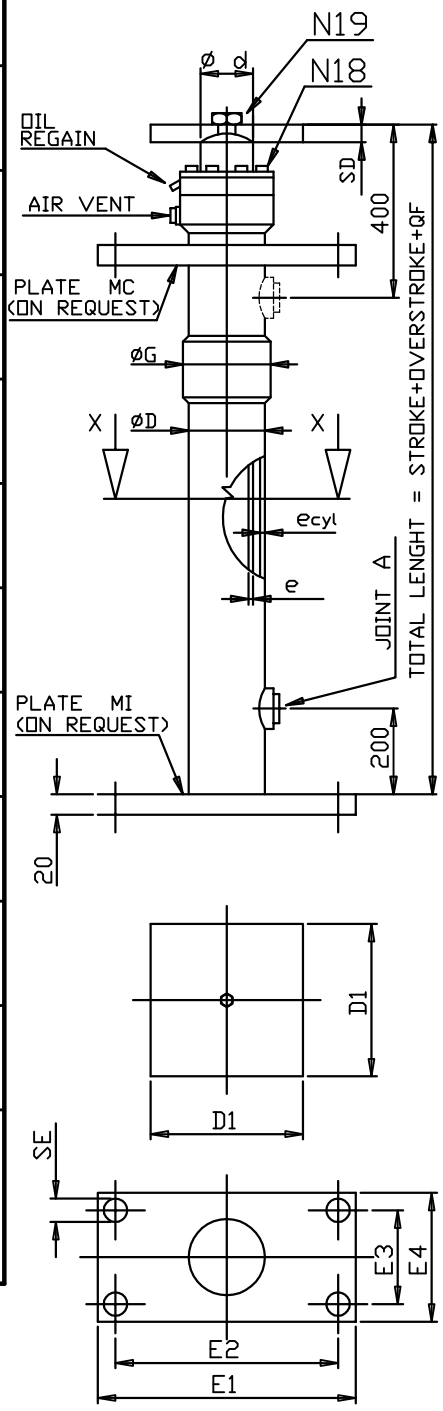
NOTE

1 - MORIS ITALIA REQUIRES ADJUSTMENT
OF ROD PROTECTION RING
FOR MEASURES HIGHER THAN 3000 mm
FOR SINGLE RAM IN ORDER TO
AVOID COLLISIONS AND DAMAGES
DURING THE TRANSPORT

2 - THE RECOMENDED MAXIMUM
LENGHT OF THE RAMS MCE-MCS IS 6500 mm
BEYONDE THIS MEASURES THE CORRECT
FUNCTIONALITY OF RAMS IS NOT GUARANTIEED

UT			ROPING 2:1 FOR LIFT PLATFORM	DATE 07/21
				DWG N. 9131/MCE-MCS

A	N18	N19	Q F	øG	e cyl	øD	OIL lxm	1 m Additional	3 m on Stroke whith oscillating plate	Kit Joints Rod + Cylinder	MI plate on request	e	ROD ød
								WEIGHT Kg					
SEE HYDRAULIC POWER UNIT	M14x55	M30x60 Ch=46	250	228	5.9	193.7	26	63	243	61	15	10	150
								50	201	66		6	
	M12x45		250	202	5.6	177.8	22	59	221	36	13	12	130
								47	182	42		7.5	
								40	160	45		5	
			250	190	5	159	17.5	52	193	26	12	12	120
								41	159	34		7.5	
								34	138	37		5	
			250	190	5	159	17.5	49	182	23	12	12	110
								39	151	26		7.5	
								33	133	29		5	
			235	166	4.5	139.7	13.5	42	154	18	8	12	100
								33	126	21		7.5	
								28	111	23		5	
	M10x45		235	155	4.5	133	12	38	138	14	8	12	90
								30	113	16		7.5	
								26	100	17		5	
			235	133	4	114.3	9				7		85
								26	98	13		7.5	
			235	133	4	114.3	9	31	114	10	7	12	80
								25	95	12		7.5	
								21	83	13		5	
			235	133	4	114.3	9	23	88	10	7	7.5	70
								20	79	11		5	
			235	/	3.6	101.6	7	19	75	–	6	7.5	60
								16	68	–		5	
		M24x70 Ch=36	235	/	3.6	101.6	7	16	68	–	6	7.5	50
								15	64	–		5	



SECTION X-X

-PLATES "MC" AND "MI" ARE IDENTICAL

-ROD UPPER PLATE IS OF OSCILLATING TYPE

-FULLY EXTENDED RAM WITH SLOWING BUFFER 35 mm

-NB.: JOINT "A" DOWN (UP ON REQUEST)

ROD Dia	D_1	S_D	E_1	E_2	E_3	E_4	S_E
50/60	150	25	300	250	80	130	22
70	150	25	300	250	90	140	22
80/85	150	25	300	250	110	160	22
90	150	25	300	250	120	170	22
100	150	25	300	250	120	180	22
110/120	200	25	400	350	150	200	22
130	200	25	400	350	160	220	22
150	200	25	400	350	200	250	22

NOTE

MORIS ITALIA PRESCRIBES THE ADOPTION OF THE RAM PROTECTION RING,
- FOR SINGLE PIECE RAMS WITH LENGHT GREATER THAN 4,5 m FOR DIAMETERS FROM 70 mm TO 90 mm,
- FOR SINGLE PIECE RAMS WITH LENGHT GREATER THAN 5 m FOR DIAMETER OF 100 mm,
- FOR SINGLE PIECE RAMS WITH LENGHT GRATER THAN 6 m FOR DIAMETERS FROM 110 mm TO 130 mm,

IN ORDER TO AVOID BUMPS AND DAMAGE DURING THE TRASPORT.

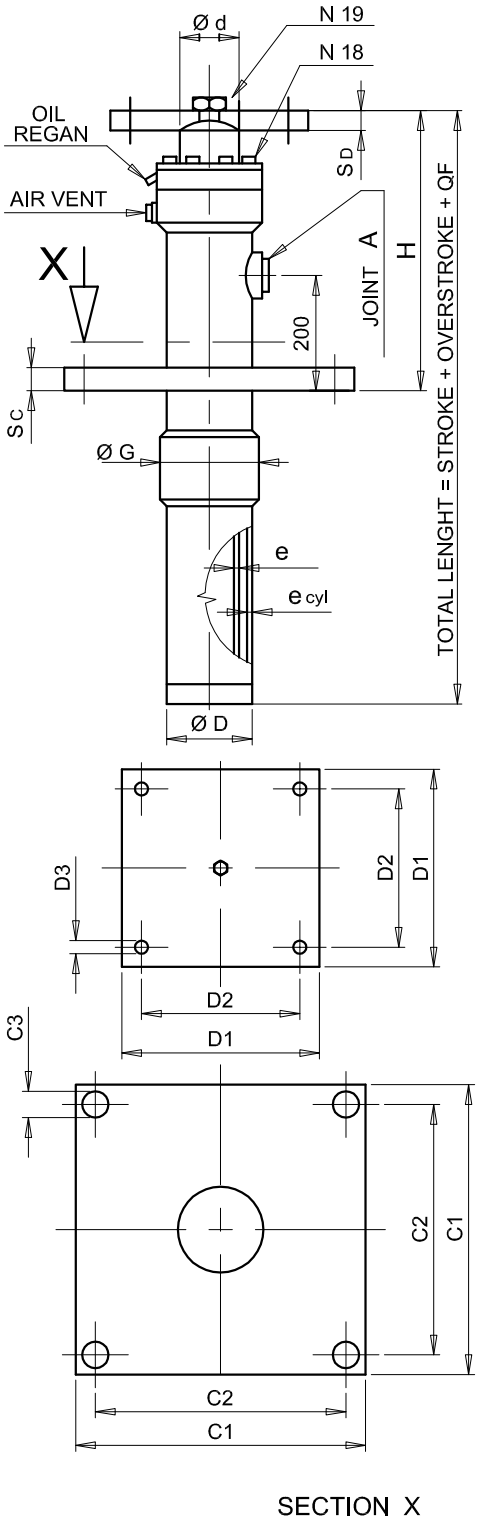
UT

DIRECT SIDE ACTING 1 : 1 RAM

DATE 10/18

DWG. Nr 9140

A	N18	N19	Q F	H	ØG	e cyl	ØD	OIL l x mt	WEIGHT Kg: 1 m Additional	WEIGHT Kg: 3 m on Stroke	WEIGHT Kg: Kit Joints Rod + Cylinder	e	ROD Ød
SEE HYDRAULIC POWER UNIT	M18x70	M60 x p. 3.5 L=120 Ch=80	295	660	304	10	273	50	113	543	134	10	200
	M16x65		295	660	278	8	244.5	41	90	461	100	10	180
	M14x55		295	660	249	8	219.1	32.5	79	415	70	10	160
		M30x60 Ch=46	250	600	228	5.9	193.7	26	63	294	61	10	150
									50	252	66	6	
	M12x45		250	600	202	5.6	177.8	22	59	272	36	12	130
									47	233	42	7.5	
									40	211	45	5	
			250	600	190	5	159	17.5	52	244	26	12	120
									41	210	34	7.5	
									34	189	37	5	
			250	600	190	5	159	17.5	49	233	23	12	110
									39	202	26	7.5	
									33	184	29	5	
			235	580	166	4.5	139.7	13.5	42	186	18	12	100
									33	158	21	7.5	
									28	143	23	5	
	M10x45		235	580	155	4.5	133	12	38	170	14	12	90
									30	145	16	7.5	
									26	132	17	5	
			235	580	133	4	114.3	9	26	132	13	7.5	85
			235	580	133	4	114.3	9	31	148	10	12	80
									25	129	12	7.5	
									21	117	13	5	
			235	580	133	4	114.3	9	23	122	10	7.5	70
									20	113	11	5	
			235	580	/	3.6	101.6	7	19	108	-	7.5	60
									16	101	-	5	
		M24x70 Ch=36	235	580	/	3.6	101.6	7	16	101	-	7.5	50
									15	97	-	5	



SECTION X

NOTE:
- MORIS ITALIA PRESCRIBES THE ADOPTION OF THE RAM PROTECTION RING,
  FOR SINGLE PIECE RAMS WITH LENGHT GREATER THAN 4,5 m FOR DIAMETERS FROM 70 TO 90 mm,
  FOR SINGLE PIECE RAMS WITH LENGHT GREATER THAN 5 m FOR DIAMETER OF 100 mm,
  FOR SINGLE PIECE RAMS WITH LENGHT GREATER THAN 6 m FOR DIAMETERS FROM 110 TO 130 mm
  IN ORDER TO AVOID BUMPS AND DEMAGE DURING THE TRANSPORT.
- ROD UPPER PLATE IS OF OSCILLATING TYPE
- ROD WITH FRONT SHOCK ABSORBER (ALL OUT) 35 mm.

ROD Dia	C 1	C 2	C 3	S C	D 1	D 2	D 3	S D
50 / 100	350	280	20	25	260	210	16	25
110 / 150	400	330	28	30	350	290	20	25
160 / 238	560	460	30	35	350	290	20	30

UT

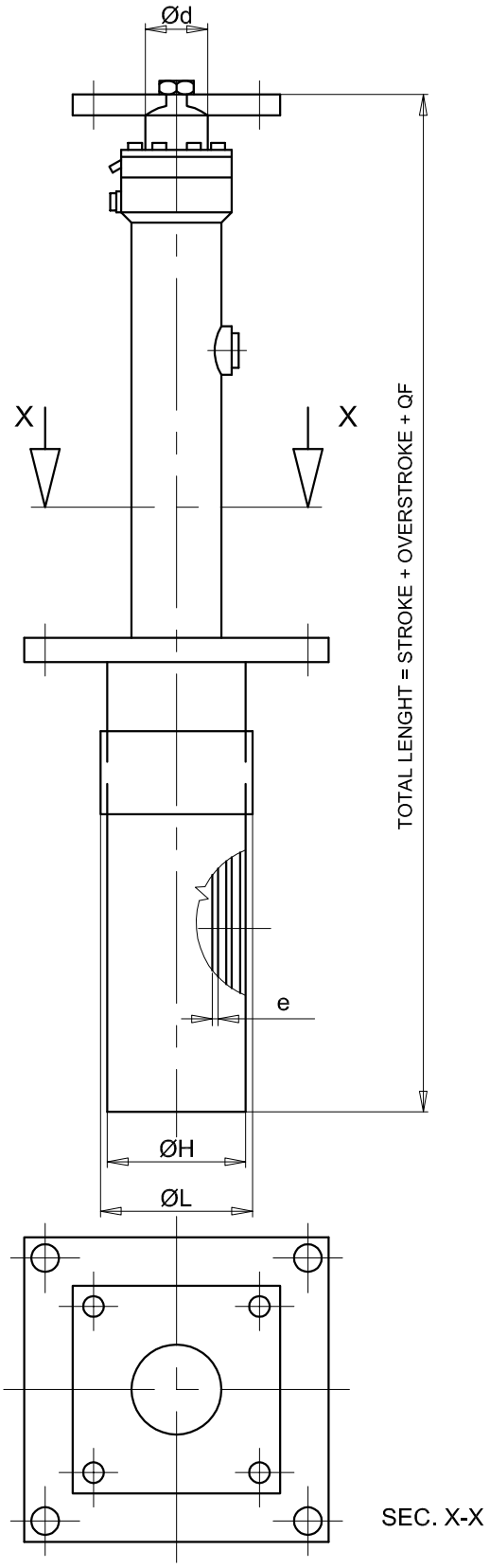
DIRECT UNDERGROUND 1 : 1 RAM

DATE 07/17

DWG Nr 9150

9150-IN

Q F	øL	øH	WEIGHT Kg 1 m	WEIGHT Kg 4 m	e	ROD ød
390	365	323.9	205	985	10	200
390	322	298.5	172	848	10	180
340	293	267	148	722	10	160
330	270	244.5	124	618	10	150
			112	568	6	
320	245	219.1	65	343	12	130
			53	295	7.5	
			45	265	5	
310	220	193.7	58	302	12	120
			47	258	7.5	
			41	230	5	
310	220	193.7	50	264	12	110
			40	225	7.5	
			34	202	5	
295	200	177.8	69	340	12	100
			60	304	7.5	
			54	280	5	
295	200	177.8	38	188	12	90
			30	157	7.5	
			27	145	5	
295	175	152	26	136	7.5	85
295	175	152	31	158	12	80
			25	132	7.5	
			22	120	5	
295	175	152	44	205	7.5	70
			40	190	5	
295	155	133	31	164	7.5	60
			28	152	5	



SEC. X-X

NOTE:
- MORIS ITALIA PRESCRIBES THE ADOPTION OF THE RAM PROTECTION RING,
  FOR SINGLE PIECE RAMS WITH LENGHT GREATER THAN 4,5 m FOR DIAMETERS FROM 70 TO 90 mm,
  FOR SINGLE PIECE RAMS WITH LENGHT GREATER THAN 5 m FOR DIAMETER OF 100 mm,
  FOR SINGLE PIECE RAMS WITH LENGHT GREATER THAN 6 m FOR DIAMETERS FROM 110 TO 130 mm.
  IN ORDER TO AVOID BUMPS AND DEMAGE DURING THE TRANSPORT.
- FOR ALL OTHER MEASUREMENTS SEE DWG N° 9130
- ROD WITH FRONT SHOCK ABSORBER (ALL OUT) 35 mm.

UT		DIRECT UNDERGROUND 1:1 RAM WITH DOUBLE CYLINDER	DATE 07/17
			DWG N. 9160

DIMENSION AND TECHNICAL DATA

TYPE	RAM					CYLINDER					CYLINDER BOTTOM				OIL VOLUME		TOTAL WEIGHT
	d	**e**	**A**	**P_{rx}**	**P_{cx}**	**D**	**e_{cyl}**	**bc**	**d2**	**d3**	**e1**	**u1**	**h1**	**s1**	**V_c**	**V_r**	**kg**
80x5	80	5	5027	0,0092	---	100	5	89	110	110	24	6	24	6,5	5,0	1,3	20 x **S** + 22
80x7,5		7,5		0,013	5,6												25 x **S** + 23
80x12		12		0,020													30 x **S** + 24
90x5	90	5	6362	0,011	---	110	5	95.5	125	120					6,4	1,5	23 x **S** + 24
90x7,5		7,5		0,015	7,2												28 x **S** + 26
90x12		12		0,023													40 x **S** + 37
100x5	100	5	7854	0,012	---	120	5	102	131	130					7,9	1,6	26 x **S** + 28
100x7,5		7,5		0,017	5,2												31 x **S** + 29
100x12		12		0,026													38 x **S** + 30

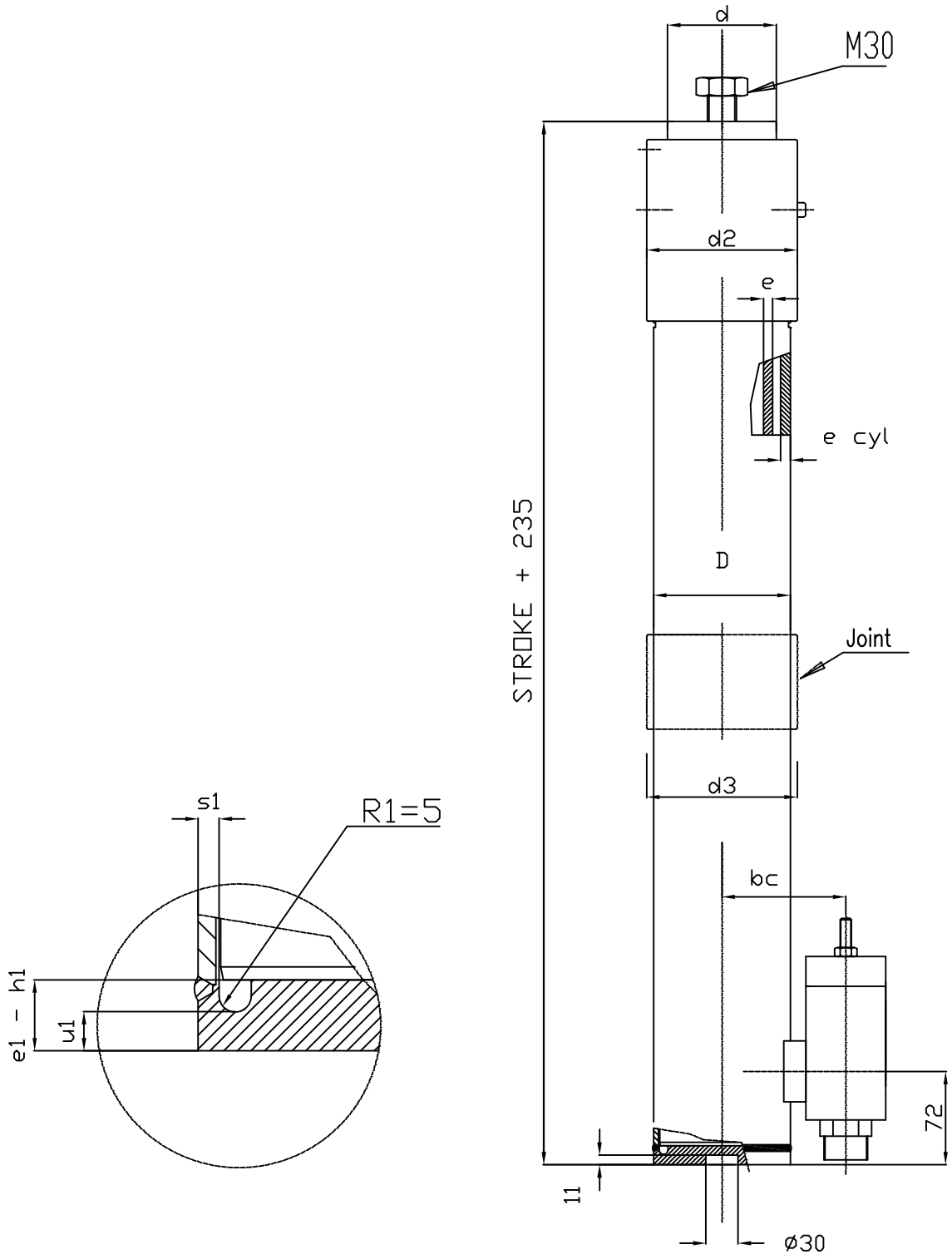
Jack stroke min. = 1750 mm

Jack stroke min. (not jointed type) = 9000 mm

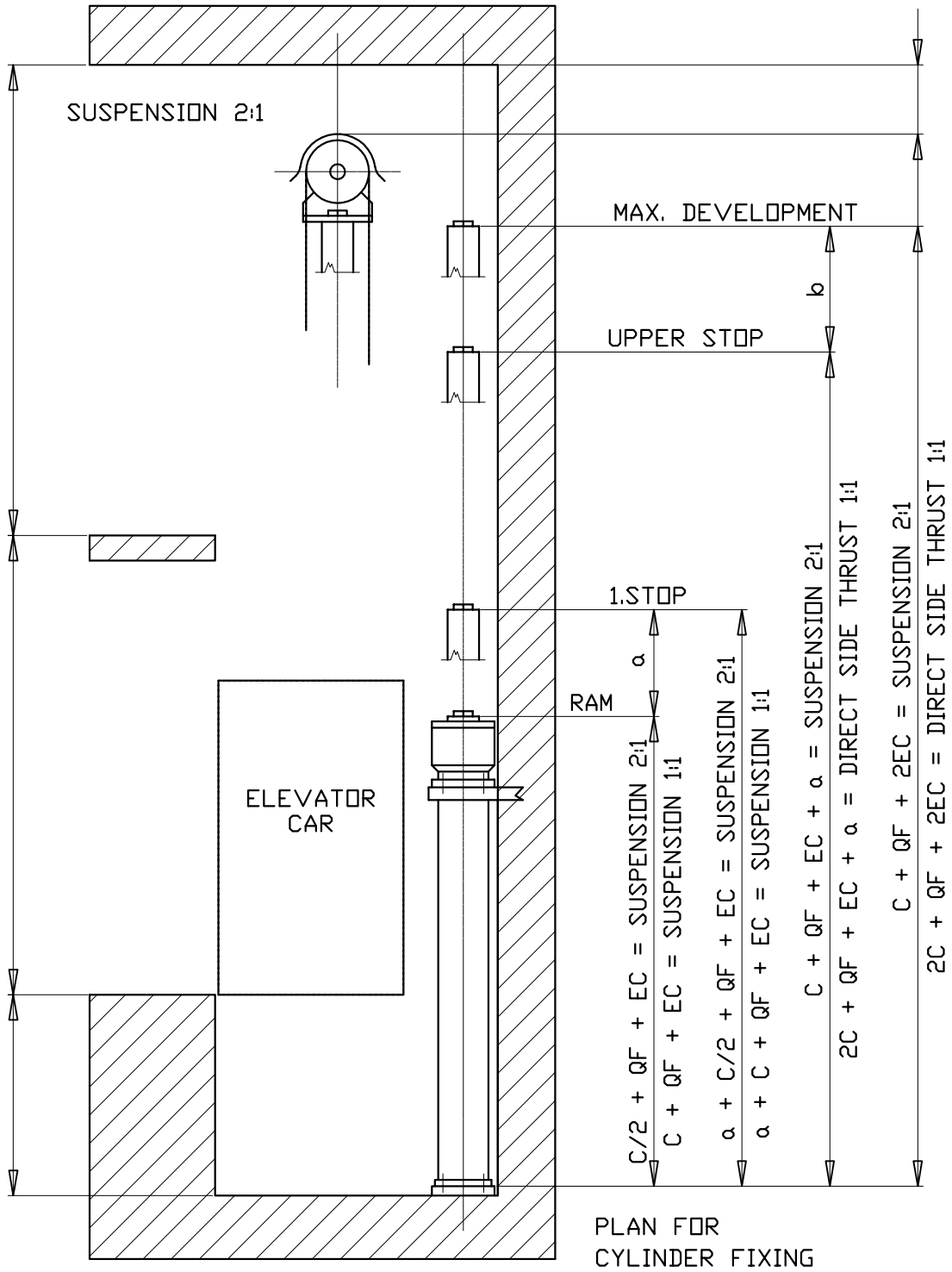
Jack stroke MAX (jointed type) = 12000 mm

Maximum static pressure = 5 MPa

UT			HL JACK TYPE COMPACT	DATE 04/23
				DWG N. 9180/10 (1/2)



UT		HL JACK TYPE COMPACT	DATE 04/23
			DWG N. 9180/10 (2/2)



C : STROKE

EC : EXTRA STROKE (a+b)

	SIDE RAM	DATE 02/16
		DWG N. 9315

Calculation of the cabin lowering due to pressure variation

Follow the formula below to calculate the maximum movement of the cabin, due to the compressibility of the oil, only during the loading / unloading phases of a mass into and out of the cabin:

$$LOWERING\ OF\ THE\ CABIN = Z * Q * c^2$$

Where:

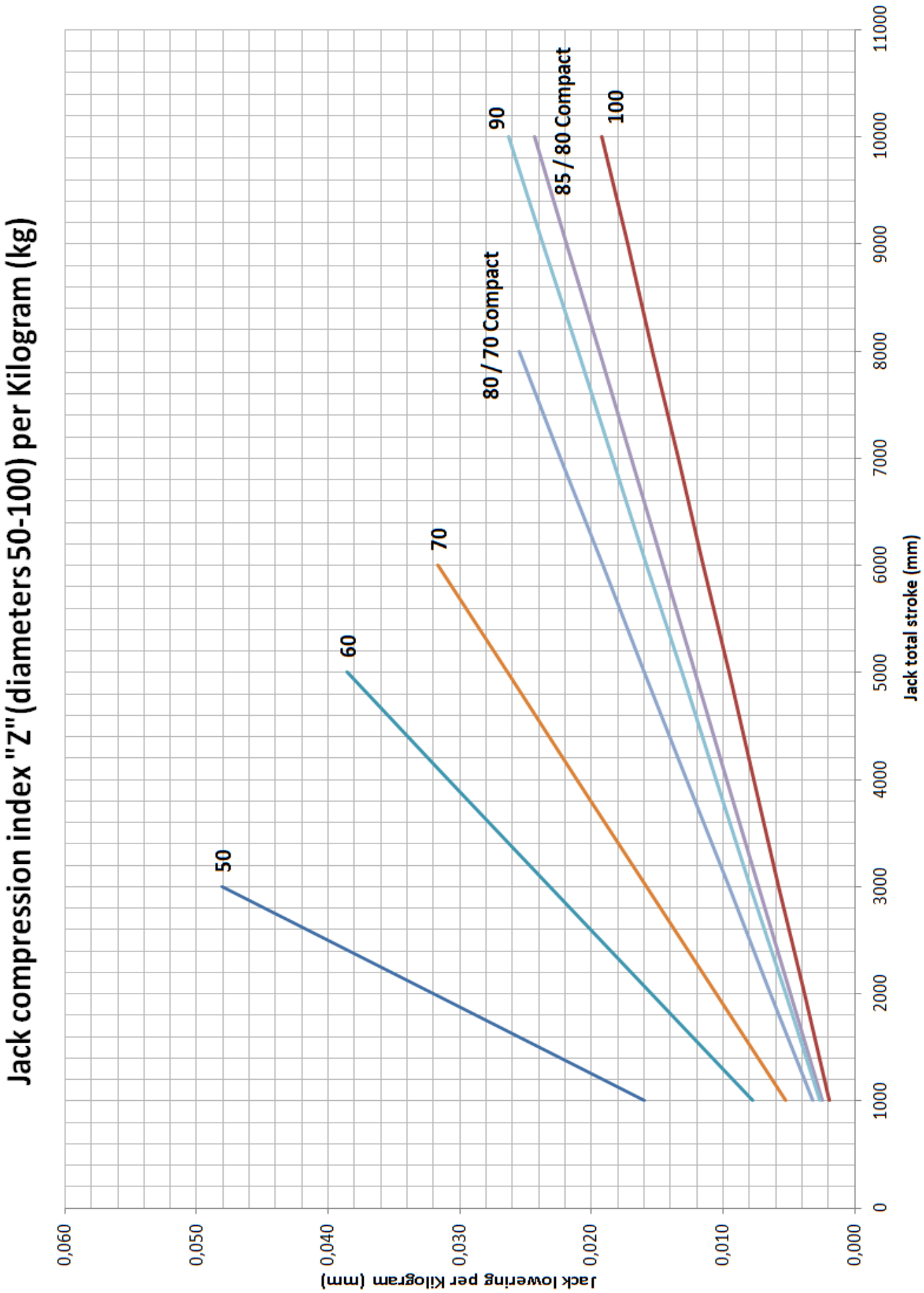
Z = piston lowering index for each Kg applied (see tables 9180/2 and 9180/3). Each index depends on the type and diameter of piston and the total piston stroke. Use stroke of jack and not the one of the cabin.

Q= cabin capacity (kg)

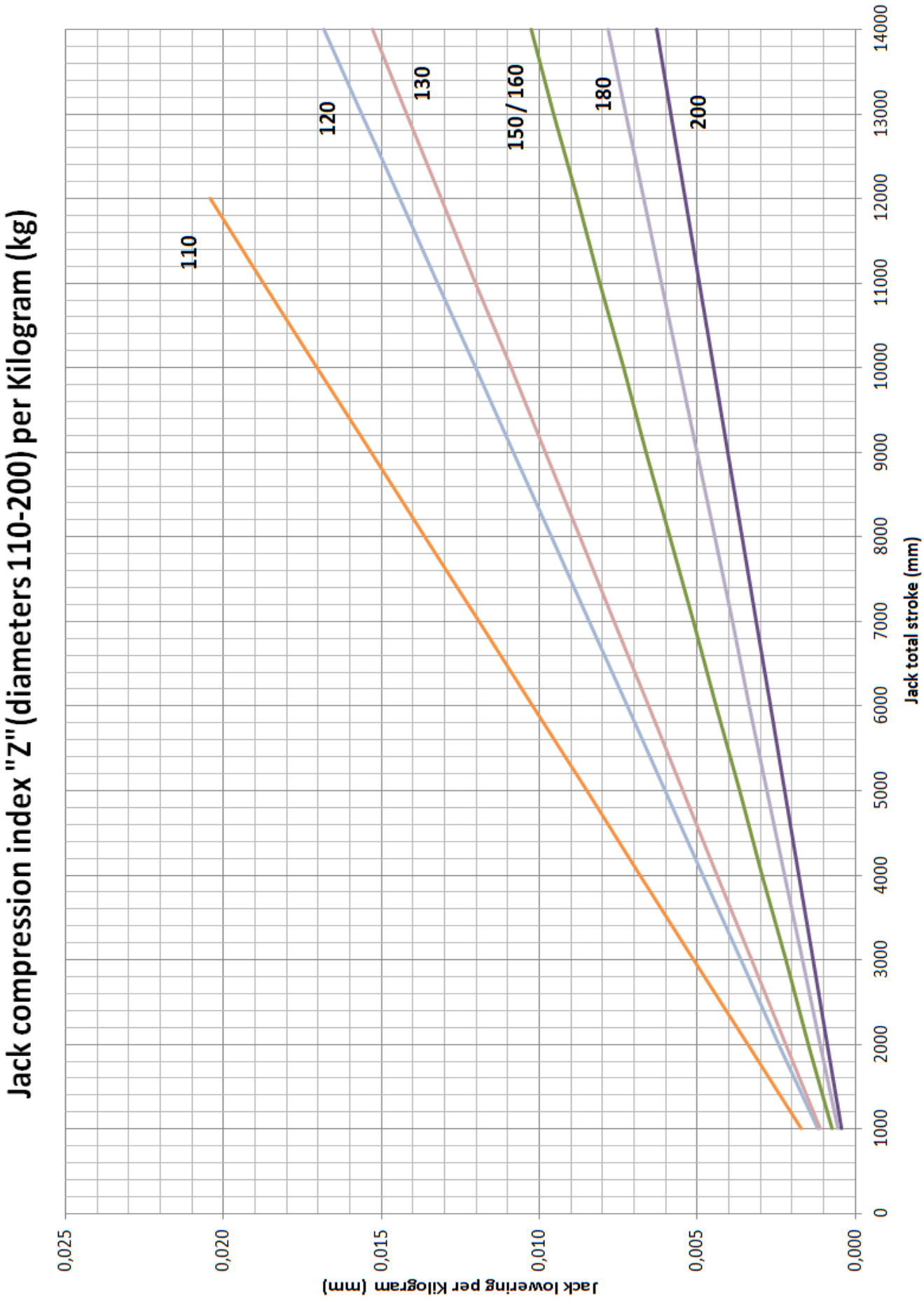
c= roping factor (direct=1; 2:1 roped=2)

NOTE: the calculation is made in the most critical condition, with a fully extended jack and during loading / unloading of all the total capacity Q.

NOTE 2: the piston lowering indexes (tables 9180/2 and 9180/3) are valid only for jack made by Moris.



Sheet 1 of 1	**CALCULATING COMPRESSIBILITY OIL**	DATE 12/18
	JACK Ø50-Ø100	**9180/2**



Sheet 1 of 1	**CALCULATING COMPRESSIBILITY OIL**	DATE 12/18
	JACK Ø110-Ø200	**9180/3**

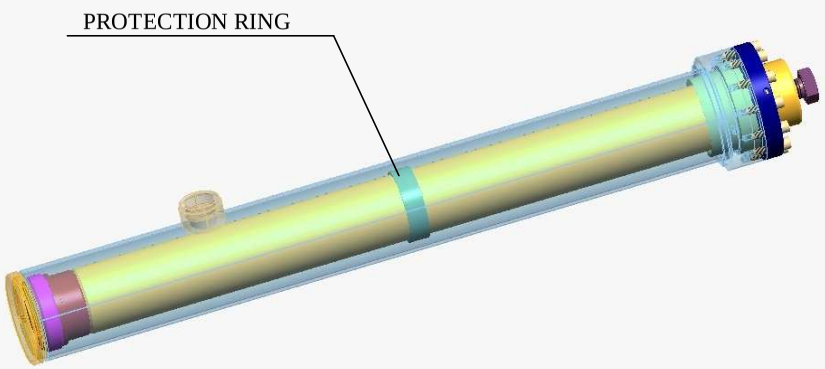
9330/AT- ING

UT

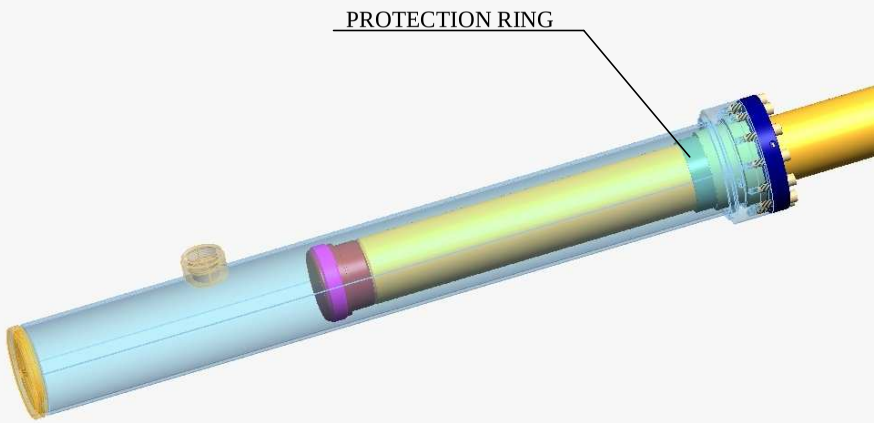
PROTECTION ROD SYSTEM FOR TRASPORTATION

DATE 02/10

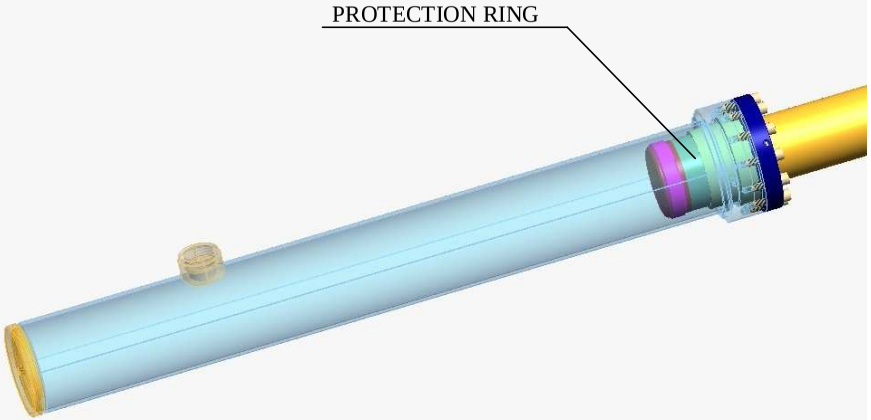
DWG Nr. 9330/AT



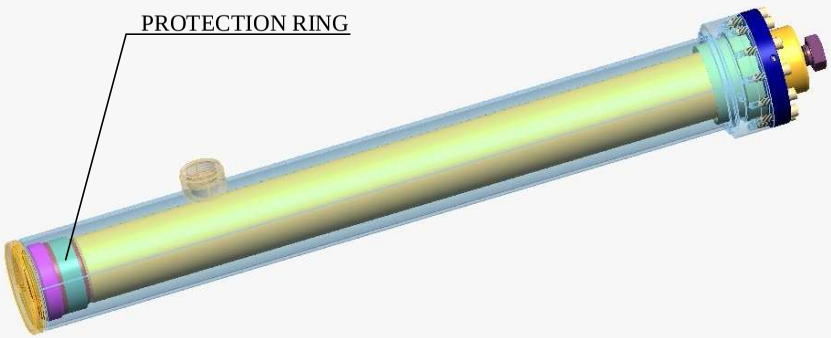
PHASE 1: PROTECTION RING POSITIONED BY MORIS ON THE MIDDLE OF THE ROD, TO SAFEGUARD IT FROM FORTUITOUS HITS AGAINST THE CYLINDER DURING TRANSPORTATION.



PHASE 2: FIRST RUN OF THE ROD AFTER INSTALLATION. THE PROTECTION RING DURING THE ROD TRAVEL, ENCOUNTERS THE RING-HOLDING HEAD, AND BEGINS TO SLIDE ON THE ROD.



PHASE 3: AUTOMATIC POSITIONING AND CONSEQUENT LOCKING IN PLACE OF THE PROTECTION RING ON THE BOTTOM OF THE ROD, IN A SPECIFIC SEAT.



PHASE 4: THE PROTECTION RING STAYS PERMANENTLY LOCKED ON THE ROD BOTTOM, AND RESTORES THE ORIGINAL BOTTOM SHAPE AND FUNCTIONS.