MORIS
Macchine Oleodinamiche
Riduttori Impianti Speciali

Chapter 3

PISTON SELECTION

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DRAWING	DESCRIPTION
9019/1	Calculation methods for buckling force applied to rod (UNI-EN 81.2)
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 81.2)
9030/1-1	Table for checking the max. loads rams from Dia 110 to Dia 130 (European standard EN 81.2)
9030/1-2	Table for checking the max. loads rams from Dia 150 to Dia 238 (European standard EN 81.2)
HL/9017	Table to determine the rates of pressure – speed – pump – motor relative to ram type and load (Telescopic piston with two extractors)
9600/51	Table to determine the rates of pressure – speed – pump – motor relative to ram type and load (Telescopic pistons with two extractors)
9600/52	Table to determine the rates of pressure – speed – pump – motor relative to ram type and load (Telescopic pistons with three extractors)
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UT

Index Chapter 3

PISTON SELECTION

DATE 01/13

IN-CHAP-03

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 81.2** HARMONISED FOR $\lambda \geq$ **100**

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

FOR $\lambda < 100$

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

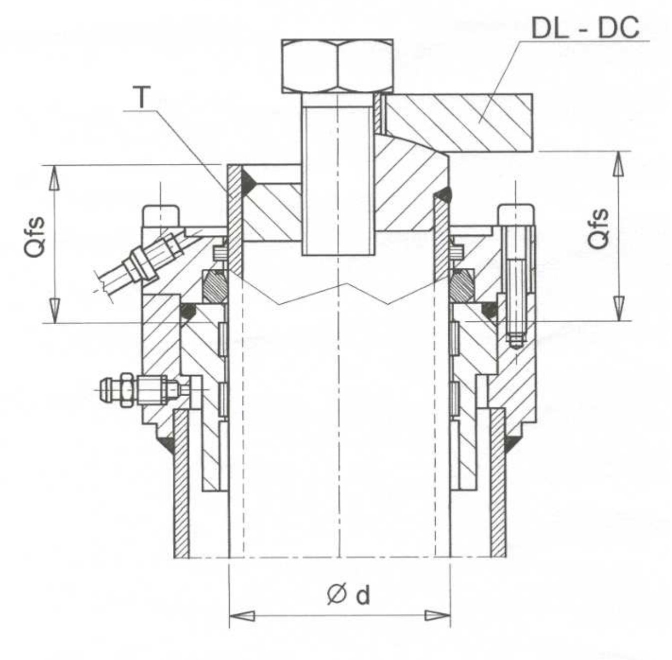
2) IMPORTANT FORMULAS

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

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

$i \sqrt{\frac{J}{A}}$ [mm] $A_p = \frac{d\pi}{4}$ $[mm^2]$

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



Ø 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

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CALCULATION METHODS FOR BUCKLING FORCE APPLIED TO RODS (UNI-EN 81.2)

DATE 09/09

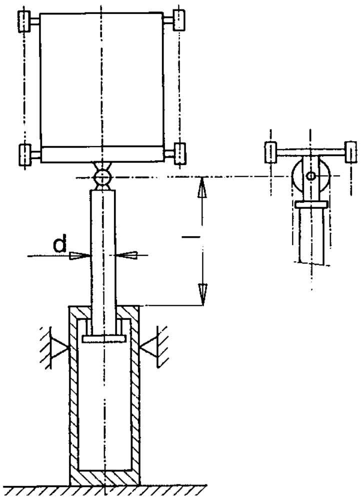
DWG N **9019/1**

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 $S_t52.0\,\sigma$ 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 81.2 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.



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SYMBOLS AND NOTES FOR BUCKLING FORCE TO BE CALCULATED

DATE 05/02

DWG N **9019/2**

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

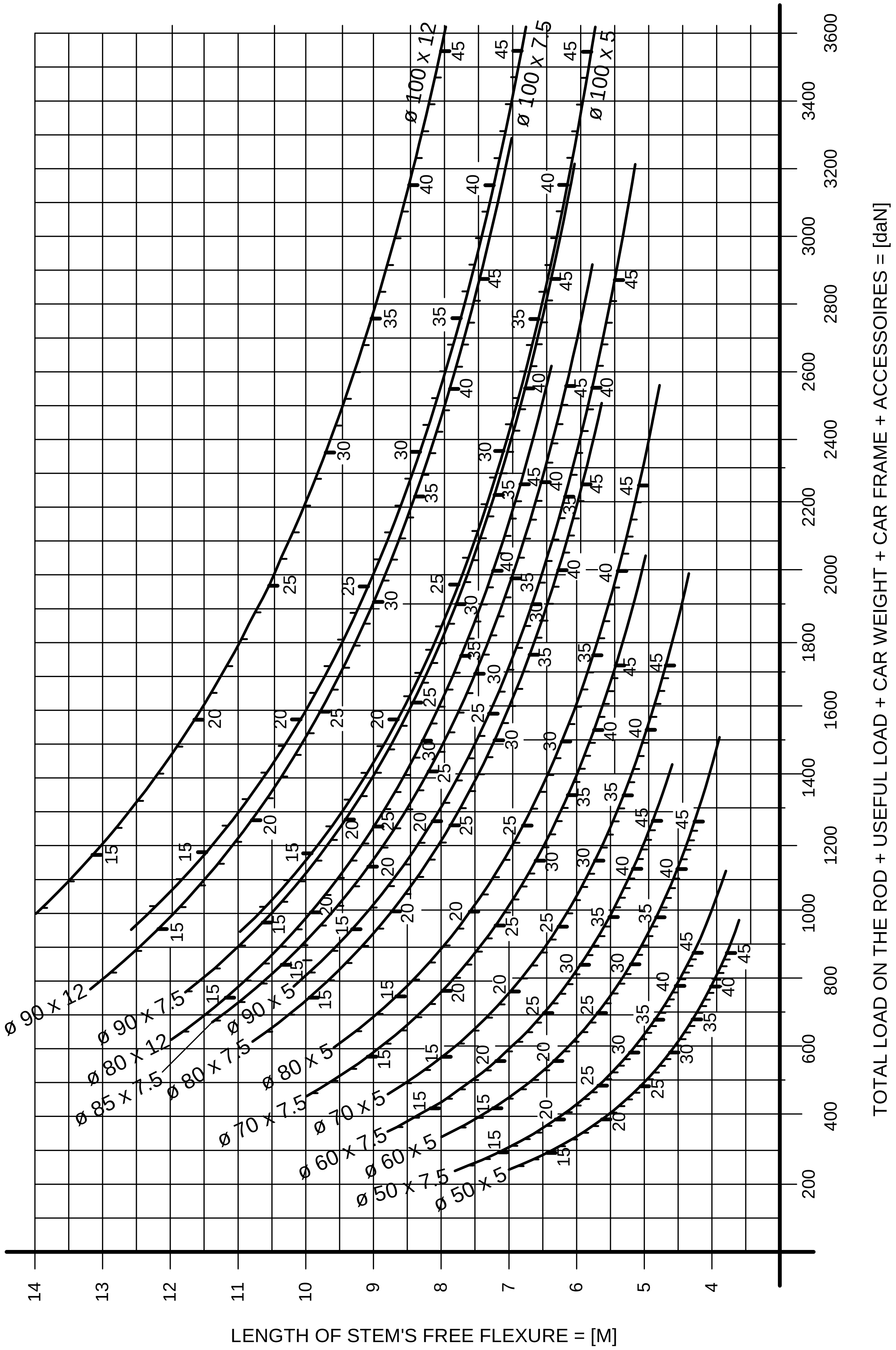

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TABLE FOR CHECKING THE MAX. LOADS
FOR RAMS ø50 A ø100

(EUROPEAN STANDARD EN 81.2)

DATE
09/09

DWG Nr
9020/1

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

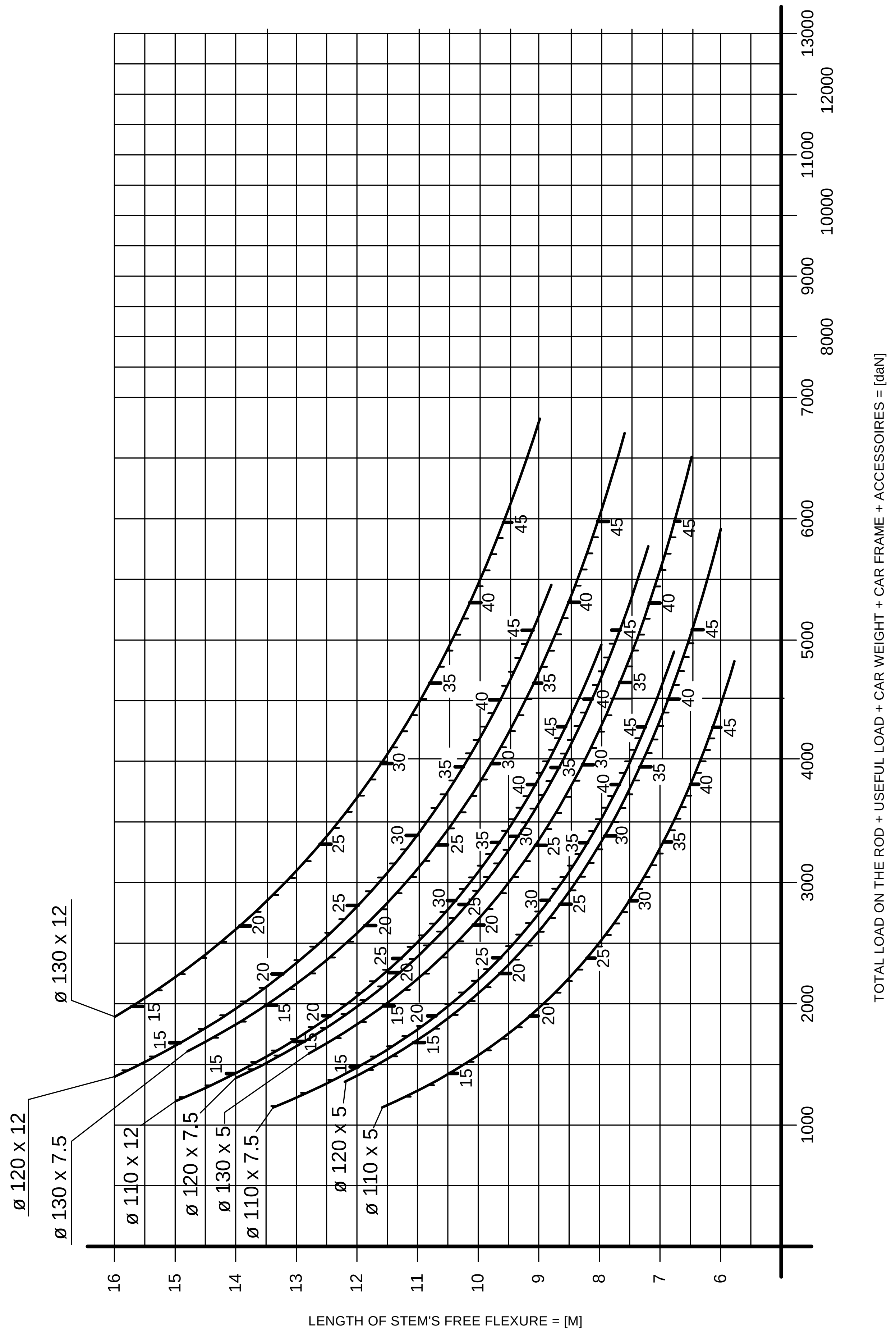

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TABLE FOR CHECKING THE MAX. LOADS
FOR RAMS ø 110 A ø130
(EUROPEAN STANDARD EN 81.2)

DATE
09/09

DWG N°
9030/1-1

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

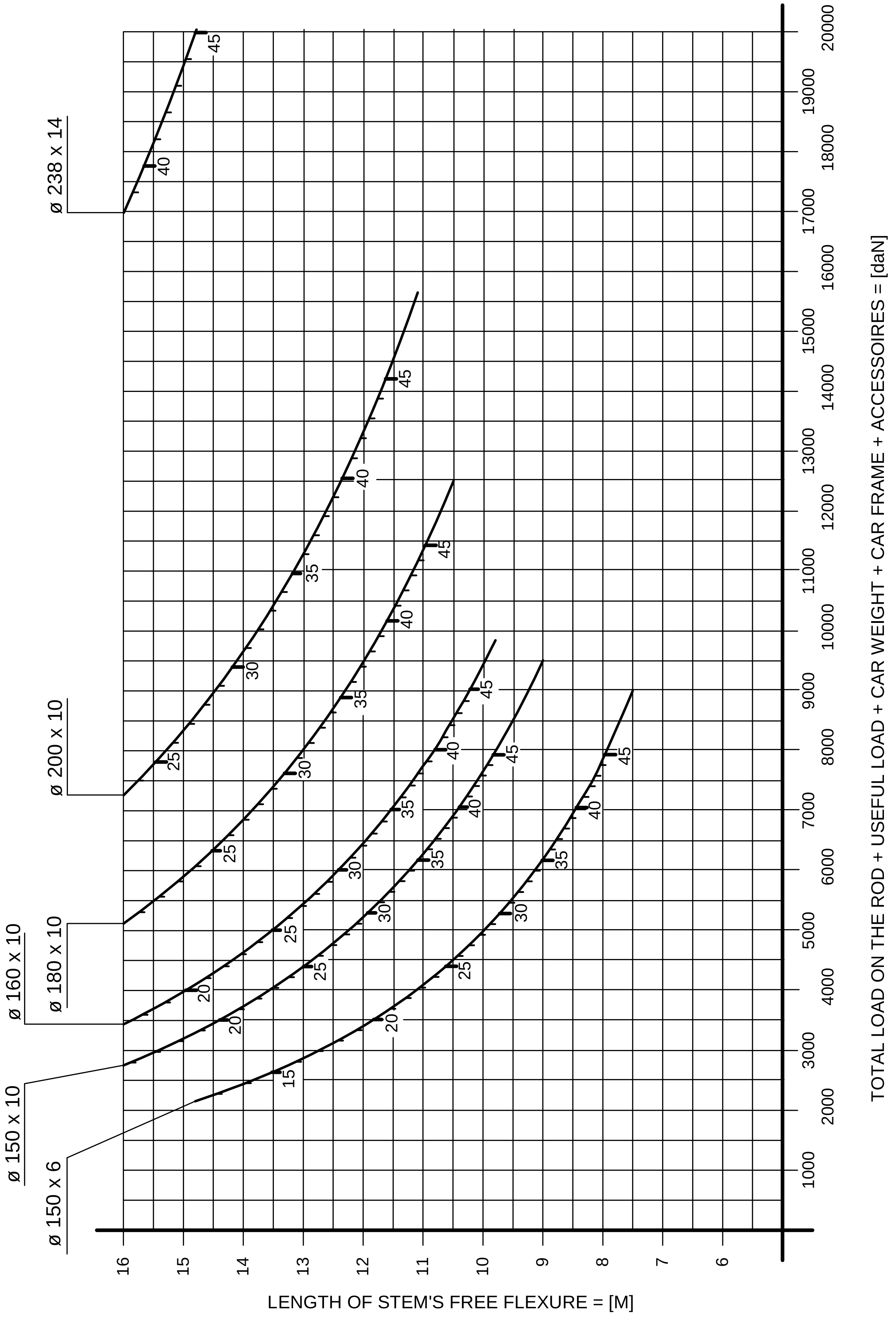

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TABLE FOR CHECKING THE MAX. LOADS
FOR RAMS ø 150 A ø238
(EUROPEAN STANDARD EN 81.2)

DATE
09/09

DWG N°
9030/1-2

PUMP L/1'														RAM	STATIC PRESSURE IN BARS																	
650	500	440	380	330	300	250	210	180	150	125	100	75	55	TYPE "H"	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46
						1.06	0.89	0.76	0.64	0.53	0.42	0.32	0.23	60/80	302	380	459	537	616	694	773	852	930	1009	1087	1166	1244	1323	1401	1480	1558	1637
														60/80-G	188	266	345	423	502	581	659	738	816	895	973	1052	1130	1209	1287	1366	1444	1523
			1.03	0.90	0.82	0.68	0.57	0.49	0.41	0.34	0.27	0.20	015	75/100	441	563	686	809	931	1054	1177	1300	1422	1545	1668	1790	1913	2036	2158	2281	2404	2526
														75/100-G	329	451	574	697	820	942	1065	1188	1310	1433	1556	1678	1801	1924	2046	2169	2292	2415
	0.94	0.83	0.72	0.62	0.57	0.47	0.40	0.34	0.28	0.23	0.19	0.14	0.10	90/120	783	959	1136	1313	1490	1666	1843	2020	2196	2373	2550	2726	2903	3080	3256	3433	3610	3787
														90/120-G	695	871	1048	1225	1402	1578	1755	1932	2108	2285	2462	2638	2815	2992	3168	3345	3522	3699

MOTOR POWER H.P. (Kw)

	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
55	6 (4.5)																								8 (6)								
75	6 (4.5)														8 (6)									10 (7.5)								
100	6 (4.5)						8 (6)							10 (7.5)							13 (9.5)										
125	8 (6)								10 (7.5)							13 (9.5)							16 (12)								
150	8 (6)				10 (7.5)					13 (9.5)					16 (12)					20 (15)										
180	13 (9.5)										16 (12)					20 (15)							25 (18.5)								
210	13 (9.5)						16 (12)					20 (15)					25 (18.5)							30 (22.5)						
250	20 (15)														25 (18.5)					30 (22.5)					40 (30)						
300	16 (12)				20 (15)					25 (18.5)					30 (22.5)					40 (30)										
330	20 (15)							25 (18.5)				30 (22.5)					40 (30)											50 (37)		
380	20 (15)				25 (18.5)			30 (22.5)					40 (30)							50 (37)										
440	25 (18.5)						30 (22.5)				40 (30)							50 (37)							60 (45)					
500	25 (18.5)				30 (22.5)			40 (30)							50 (37)					60 (45)					80 (60)				
650	40 (30)							50 (37)				60 (45)				80 (60)									100 (75)					

▲ = SPEED OF RAM IN UPWARD DIRECTION m/sec
(AVERAGE LOAD)

⬢ = TOTAL LOAD
(USEFUL LOAD + CAR + CAR FRAME + ACC. = Kg)

- THE WEIGHT INDICATED IN THIS TABLE HAS BEEN CALCULATED CONSIDERING THE RODS WEIGHT FOR A MAXIMUM STROKE (SEE DWG : HL 09.01 6/10 + HL 09.01 7/10)

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TABLE TO DETERMINE THE RATES OF:
PRESSURE - SPEED - PUMP - MOTOR
RELATIVE TO RAM TYPE AND LOAD
(TELESCOPIC PISTON WITH TWO EXTRACTORS)

DATE
09/07

DWG Nr.
HL/9017

SPEED OF RAM IN UPWARD DIRECTIOM M/SEC (AVERAGE LOAD)

TOTAL LOAD (USEFUL LOAD + CAR + CAR FRAME + ACC. = kg)

PUMP L/1'														RAM TYPE	STATIC PRESSURE IN BARS																	
650	500	440	380	330	300	250	210	180	150	125	100	75	55		12	13 14	15 16	17 18	19 20	21 22	23 24	25 26	27 28	29 30	31 32	33 34	35 36	37 38	39 40	41 42	43 44	45 46
										1.18	0.94	0.70	0.52	46/2	155	191	227	262	297	331	365	400	434	470	503	539	571	606	640	677	–	–
														46/2–G1	131	170	207	244	280	316	351	387	422	457	491	527	560	597	631	–	–	–
								1.02	0.85	0.71	0.57	0.42	0.30	60/2	253	317	379	441	502	563	623	682	740	801	861	918	976	1035	1092	1155	1210	–
														60/2–G1	184	257	325	391	456	519	581	643	704	764	824	886	944	1005	1066	1125	1185	–
				1.11	1.01	0.85	0.71	0.61	0.49	0.42	0.32	0.26	0.18	77/2	424	529	633	734	834	935	1035	1135	1231	1330	1430	1523	1626	1718	1819	1911	2012	–
														77/2–G1	298	422	536	646	753	859	963	1064	1166	1268	1367	1469	1566	1668	1765	1862	1963	2061
			1.06	0.92	0.84	0.72	0.60	0.51	0.41	0.35	0.29	0.20	0.14	85/2	445	579	707	834	958	1081	1203	1323	1444	1566	1684	1803	1921	2042	2159	2277	2395	–
														85/2–G1	189	365	520	664	802	936	1067	1195	1321	1445	1570	1694	1814	1939	2059	2181	2300	–
1.26	0.97	0.87	0.74	0.62	0.57	0.49	0.41	0.35	0.29	0.24	0.19	0.13		103/2	734	921	1104	1282	1460	1640	1815	1990	2164	2333	2507	2682	2850	3024	3193	3364	–	–
														103/2–G1	492	715	921	1118	1309	1495	1679	1860	2039	2219	2395	2574	2749	2921	3099	3274	3446	–
0.96	0.73	0.64	0.55	0.47	0.43	0.36	0.31	0.26	0.21	0.18	0.15			120/2	1026	1281	1532	1778	2023	2263	2506	2744	2984	3219	3454	3693	3935	4164	4400	4642	–	–
														120/2–G1	727	1027	1305	1573	1833	2087	2338	2586	2832	3076	3320	3560	3802	4042	4284	4517	–	–
0.69	0.53	0.46	0.39	0.33	0.30	0.26	0.22	0.18	0.15	0.12				141/2	1270	1636	1993	2343	2687	3030	3369	3705	4037	4372	4706	5031	5364	5690	6016	6353	6670	6992
														141/2–G1	537	1044	1479	1881	2265	2634	2998	3354	3706	4052	4397	4739	5076	5413	5754	6086	6422	6757
0.46	0.35	0.31	0.27	0.24	0.22	0.18	0.14	0.12	0.10					170/2	2174	2673	3163	3648	4134	4608	5089	5566	6035	6509	6977	7447	7912	8382	8853	–	–	–
														170/2–G1	1680	2244	2782	3299	3806	4306	4798	5287	5774	6258	6739	7216	7689	8167	8645	–	–	–
0.32	0.24	0.21	0.19	0.15	0.14	0.12	0.09	0.08						205/2	3190	3919	4638	5346	6045	6749	7444	8143	8828	9511	10197	10893	11571	12262	12938	13613	–	–
														205/2–G1	2488	3313	4094	4848	5589	6315	7039	7748	8457	9163	9867	10565	11253	11956	12641	13339	–	–

MOTOR POWER H.P. (Kw)

	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46
55	6 (4.5)													8 (6)				
75	6 (4.5)								8 (6)					10 (7.5)				
100	6 (4.5)				8 (6)				10 (7.5)				13 (9.5)					
125	8 (6)					10 (7.5)				13 (9.5)				16 (12)				
150	8 (6)			10 (7.5)			13 (9.5)			16 (12)			20 (15)					
180	13 (9.5)						16 (12)			20 (15)				25 (18.5)				
210	13 (9.5)				16 (12)			20 (15)			25 (18.5)				30 (22.5)			
250	20 (15)								25 (18.5)			30 (22.5)			40 (30)			
300	16 (12)			20 (15)			25 (18.5)			30 (22.5)			40 (30)					
330	20 (15)				25 (18.5)			30 (22.5)			40 (30)						50 (37)	
380	20 (15)			25 (18.5)		30 (22.5)			40 (30)				50 (37)					
440	25 (18.5)				30 (22.5)		40 (30)				50 (37)				60 (45)			
500	25 (18.5)			30 (22.5)		40 (30)				50 (37)			60 (45)			80 (60)		
650	40 (30)				50 (37)			60 (45)		80 (60)					100 (75)			

THE WEIGHT INDICATED IN THIS TABLE HAS BEEN CALCULATED CONSIDERING
THE RODS WEIGHT FOR A MAXIMUM STROKE (SEE DWG. 9602/... 9603/...)

UT

TABLE TO DETERMINE THE RATES OF:
PRESSURE – SPEED – PUMP – MOTOR
RELATIVE TO RAM TYPE AND LOAD
(TELESCOPIC PISTONS WITH TWO EXTRACTORS)

DATE
01/04

DWG.N.
9600/51

9600/51–IN

SPEED OF RAM IN UPWARD DIRECTIOM M/SEC (AVERAGE LOAD)

TOTAL LOAD (USEFUL LOAD + CAR + CAR FRAME + ACC. = kg)

PUMP L/1'														RAM TYPE	STATIC PRESSURE IN BARS																	
650	500	440	380	330	300	250	210	180	150	125	100	75	55		12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46
								1.08	0.90	0.75	0.61	0.45	0.32	58/3	267	323	378	432	488	541	596	647	-	-	-	-	-	-	-	-	-	-
														58/3-G1	236	293	350	407	463	518	574	628	-	-	-	-	-	-	-	-	-	-
														58/3-G2	234	292	350	407	463	518	574	628	656	-	-	-	-	-	-	-	-	-
				1.21	1.10	0.91	0.76	0.65	0.53	0.45	0.35	0.28	0.19	75/3	449	544	636	729	822	916	1007	1096	1190	1283	1373	-	-	-	-	-	-	-
														75/3-G1	391	491	587	683	777	871	965	1058	1152	1244	-	-	-	-	-	-	-	-
														75/3-G2	355	460	561	660	758	853	948	1043	1138	-	-	-	-	-	-	-	-	-
	1.05	0.96	0.80	0.70	0.63	0.54	0.45	0.38	0.32	0.27	0.21	0.15	0.11	98/3	768	931	1089	1250	1410	1565	1726	1882	2036	2192	-	-	-	-	-	-	-	-
														98/3-G1	658	828	994	1158	1322	1484	1644	1805	1966	2124	-	-	-	-	-	-	-	-
														98/3-G2	577	763	941	1112	1281	1448	1610	1774	1935	2097	2257	-	-	-	-	-	-	-
1.17	0.90	0.81	0.68	0.58	0.53	0.45	0.38	0.32	0.27	0.22	0.18	0.13		107/3	880	1076	1266	1458	1646	1837	2024	2206	2395	2579	2762	-	-	-	-	-	-	-
														107/3-G1	733	937	1137	1333	1531	1723	1915	2106	2295	2484	-	-	-	-	-	-	-	-
														107/3-G2	550	791	1013	1224	1430	1632	1831	2028	2221	2415	-	-	-	-	-	-	-	-
0.84	0.64	0.57	0.47	0.41	0.38	0.32	0.27	0.23	0.19	0.16	0.13			127/3	1261	1536	1806	2073	2338	2608	2872	3130	3401	3662	-	-	-	-	-	-	-	-
														127/3-G1	1056	1343	1624	1904	2179	2451	2721	2994	3260	3529	-	-	-	-	-	-	-	-
														127/3-G2	903	1227	1530	1822	2107	2388	2664	2939	3211	3482	-	-	-	-	-	-	-	-
0.61	0.47	0.41	0.35	0.29	0.27	0.23	0.20	0.16	0.13	0.11				150/3	1756	2140	2519	2896	3269	3635	4007	4376	4742	-	-	-	-	-	-	-	-	-
														150/3-G1	1431	1834	2229	2619	3005	3390	3770	4145	4522	-	-	-	-	-	-	-	-	-
														150/3-G2	1272	1726	2149	2556	2955	3345	3730	4115	4494	-	-	-	-	-	-	-	-	-
0.44	0.33	0.29	0.25	0.23	0.21	0.16	0.13	0.11	0.09					176/3	2343	2876	3397	3921	4437	4947	5463	5974	6477	6990	-	-	-	-	-	-	-	-
														176/3-G1	1882	2441	2993	3531	4070	4596	5125	5646	6167	6685	7201	-	-	-	-	-	-	-
														176/3-G2	1216	1952	2592	3190	3764	4324	4874	5412	5945	6476	7001	-	-	-	-	-	-	-

MOTOR POWER H.P. (Kw)

	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46
55	6 (4.5)													8 (6)				
75	6 (4.5)								8 (6)					10 (7.5)				
100	6 (4.5)				8 (6)				10 (7.5)				13 (9.5)					
125	8 (6)					10 (7.5)				13 (9.5)				16 (12)				
150	8 (6)			10 (7.5)			13 (9.5)			16 (12)			20 (15)					
180	13 (9.5)						16 (12)			20 (15)				25 (18.5)				
210	13 (9.5)				16 (12)			20 (15)			25 (18.5)				30 (22.5)			
250	20 (15)								25 (18.5)			30 (22.5)			40 (30)			
300	16 (12)			20 (15)			25 (18.5)			30 (22.5)			40 (30)					
330	20 (15)				25 (18.5)			30 (22.5)			40 (30)						50 (37)	
380	20 (15)			25 (18.5)		30 (22.5)			40 (30)				50 (37)					
440	25 (18.5)				30 (22.5)		40 (30)				50 (37)				60 (45)			
500	25 (18.5)			30 (22.5)		40 (30)				50 (37)			60 (45)			80 (60)		
650	40 (30)				50 (37)			60 (45)		80 (60)					100 (75)			

THE WEIGHT INDICATED IN THIS TABLE HAS BEEN CALCULATED CONSIDERING
THE RODS WEIGHT FOR A MAXIMUM STROKE (SEE DWG. 9602/... 9603/...)

UT

TABLE TO DETERMINE THE RATES OF:
PRESSURE - SPEED - PUMP - MOTOR
RELATIVE TO RAM TYPE AND LOAD
(TELESCOPIC PISTONS WITH THREE EXTRACTORS)

DATE 12/99

DWG.N. 9600/52

9600/52-IN

Live load = Q (Kg) ________
Cage weight + frame + Accessories = F (Kg) ________
Weight pulley + Ropes = K (Kg) ________
(Indirect installation 2:1)

Cage speed = S (m/sec) ________

Run + over run cage = C (m) ________
Net axe distance-top of piston = I (m) ________
(Indirect installation 2:1)

Net weight on the piston = P (Kg) ________

Direct installation 1:1 with one jack = Q+F
Indirect installation 2:1 with one jack = (Q+F)x2+K
Direct installation 1:1 with double jack = (Q+F)/2
Indirect installation 2:1 with double jack = Q+F+K

Calculation length of piston = L (m) ________

Direct installation = C
Indirect installation = (C/2)+I

The diagram point at the crossing of the right lines characteristic of load 'P' and of piston length 'L' excludes the use of all jacks represented by the curves below this point.
Therefore, choose the jack which curve is the closest to this point, above.
The intersection point of the right line extension characteristic of the chosen jack gives the corresponding pressure value at full load, in BAR.
If the pressure at full charge results too high, choose the type of jack just higher.

Jack type ________________ Pressure = B (bar) ________________

Jack speed = V (m/sec) ________

Direct installation 1:1 with one jack = S
Indirect installation 2:1 with one jack = S/2
Direct installation 1:1 with double jack = Sx2
Indirect installation 2:1 with double jack = S

On the speed and power tabulation, choose the type of gear case (L/min) which better corresponds to the value of jack speed 'V'.
Engine power (CV) is that to which a higher or even static pressure (BAR) correspond to that of the jack 'B'.

type of gear case: L/min ________________ CV ________________

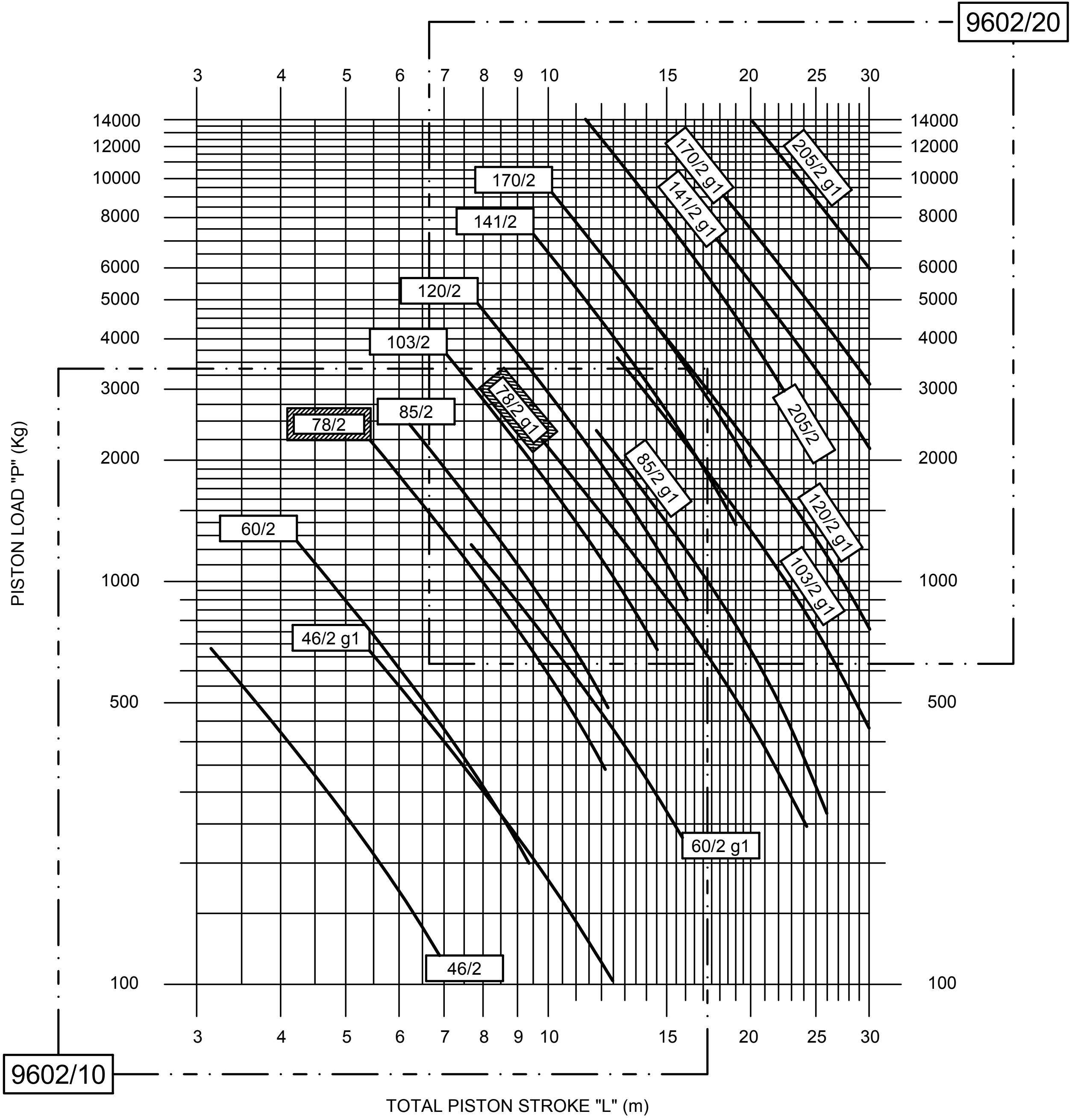
UT

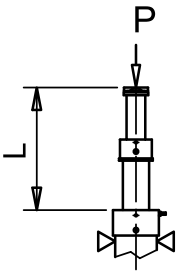
CHOICE OF THE PISTON TYPE AND OF THE POWER UNIT

DATE 08/99

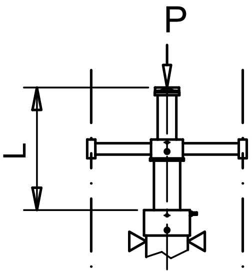
DWG N. 9601

DIAGRAM OF THE PEAK LOADS ACCORDING TO EULERO'S CALCULATION WITH SAFETY FACTOR 2 AND OVERPRESSURE FACTOR 1.4, FOR TELESCOPIC PISTONS WITH TWO EXTRACTING ELEMENTS (EN 81.2)





PISTON WITHOUT GUIDANCE
(EX. 46/2)



PISTON WITH ONE GUIDANCE
(EX. 46/2 g1)

▨ ......

PISTON TYPE OBSOLETE FROM 77/2 - 77/2-g1
FOR DIAGRAM VALUES REF DWG 9607/5

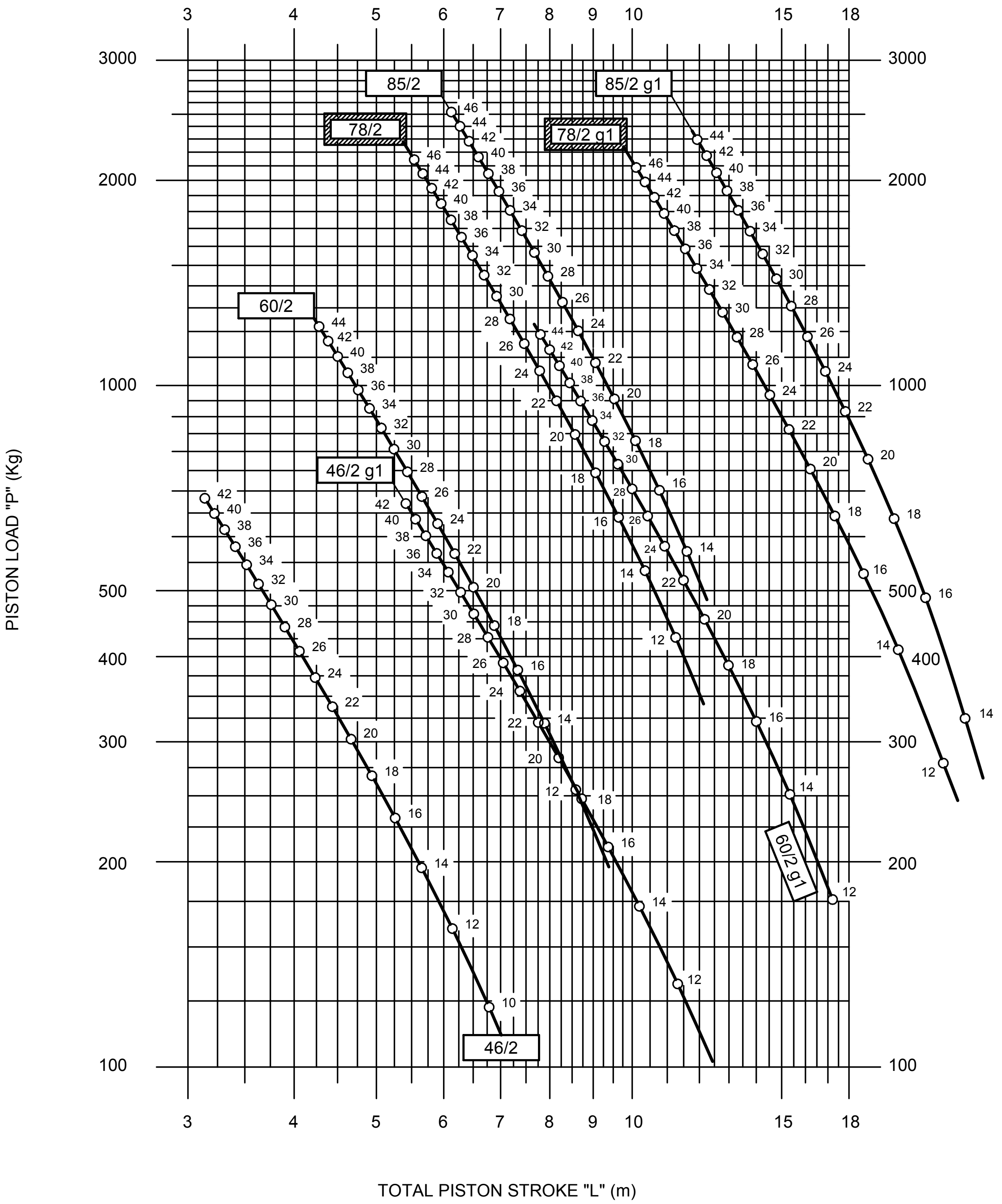
UT

DIAGRAM OF THE PEAK LOADS
GUIDELESS TELESCOPIC PISTONS
WITH TWO EXTRACTORS
(OVERPRESSURE FACTOR 1.4)

DATE 01/04

DWG N. 9602

9602-IN



▨ ......

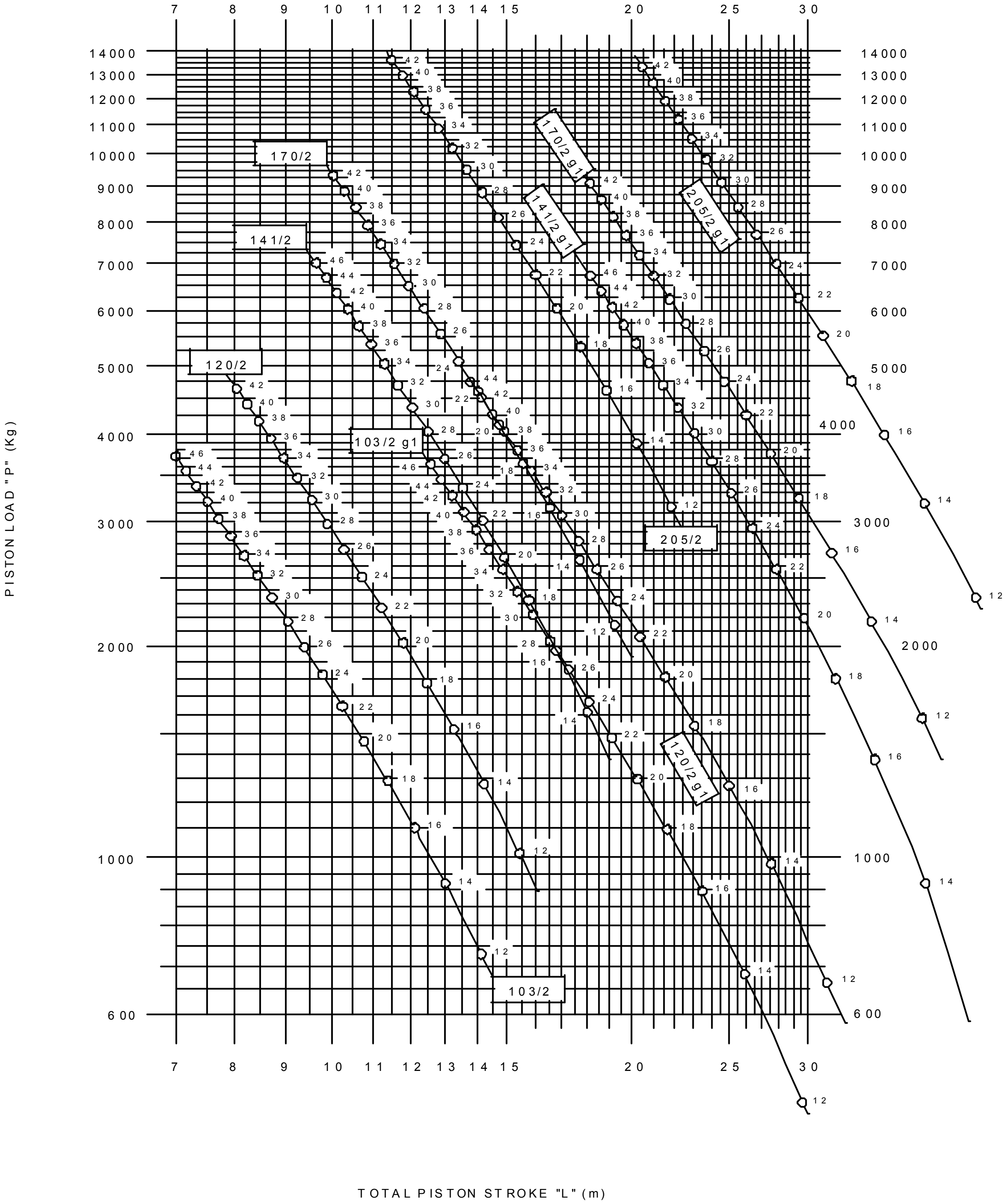
PISTON TYPE OBSOLETE FROM 77/2 - 77/2-g1
FOR DIAGRAM VALUES REF DWG 9607/5

UT		

DIAGRAM OF THE PEAK LOADS GUIDELESS TELESCOPIC PISTONS WITH TWO EXTRACTORS
(TYPE 46/2 - 60/2 - 78/2 - 85/2)
(OVERPRESSURE FACTOR 1.4)

DATE
01/04

DWG N.
9602/10



UT

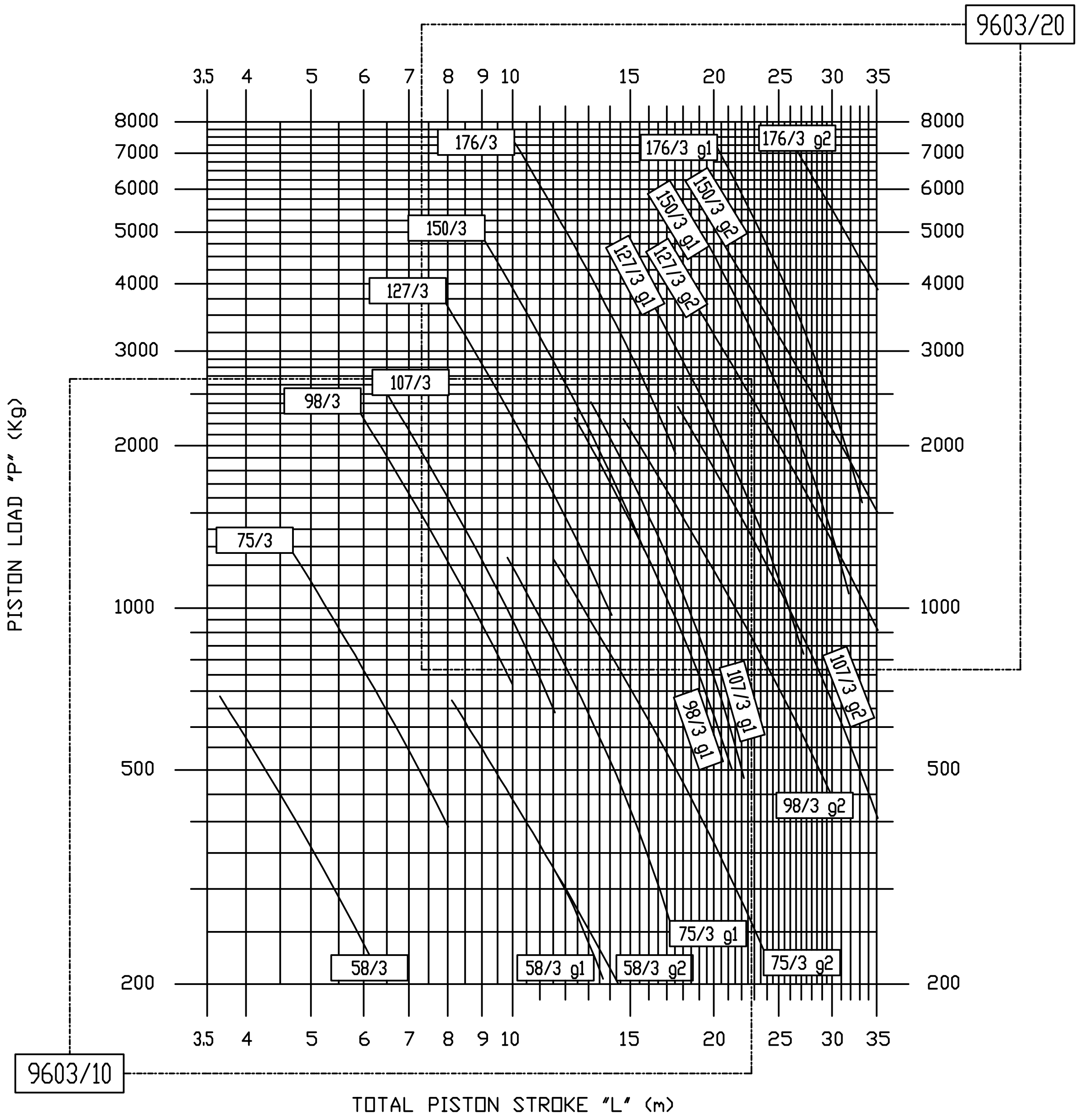
DIAGRAM OF THE PEAK LOADS GUIDELESS TELESCOPIC PISTONS WITH TWO EXTRACTORS (TYPE 103/2-120/2-141/2-170/2-205/2)

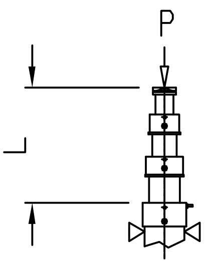
(OVERPRESSURE FACTOR 1.4)

DATE 04/03

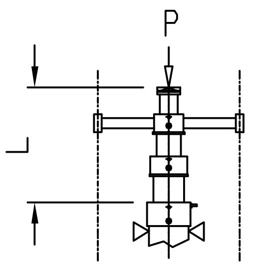
DWG N. 9602/20

DIAGRAM OF THE PEAK LOADS ACCORDING TO EULERO'S CALCULATION WITH SAFETY FACTOR 2 AND OVERPRESSURE FACTOR 1.4, FOR TELESCOPIC PISTONS WITH THREE EXTRACTING ELEMENTS (EN 81.2)

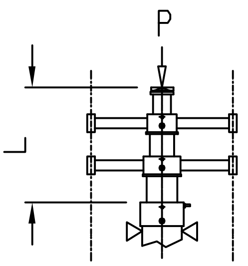




PISTON WITHOUT GUIDANCE
(EX. 58/3)



PISTON WITH ONE GUIDANCE
(EX. 58/3 g1)



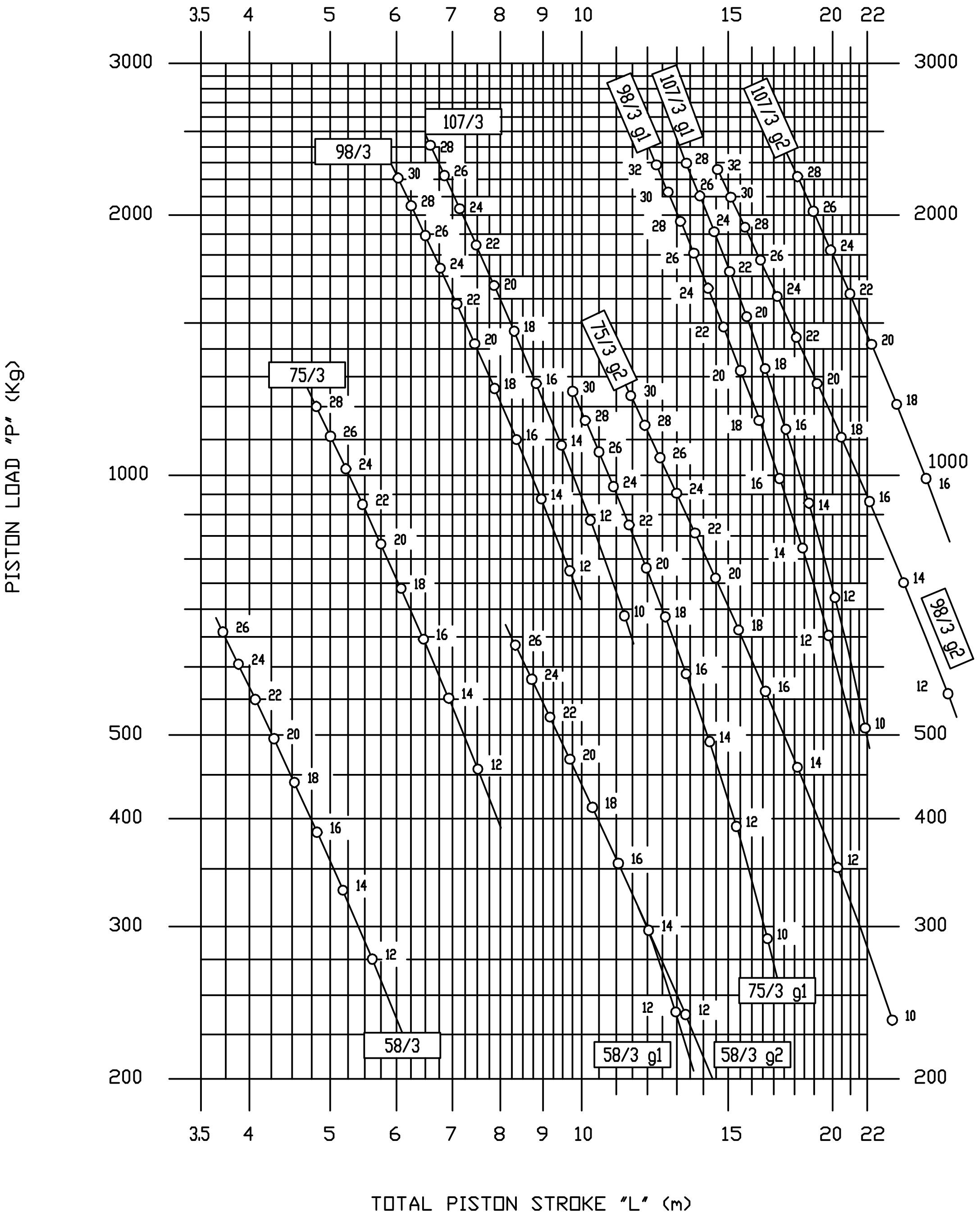
PISTON WITH TWO GUIDANCE
(EX. 58/3 g2)

UT

DIAGRAM OF THE PEAK LOADS
GUIDELESS TELESCOPIC PISTONS
WITH THREE EXTRACTORS
(OVERPRESSURE FACTOR 1.4)

DATE 08/99

DWG N. 9603



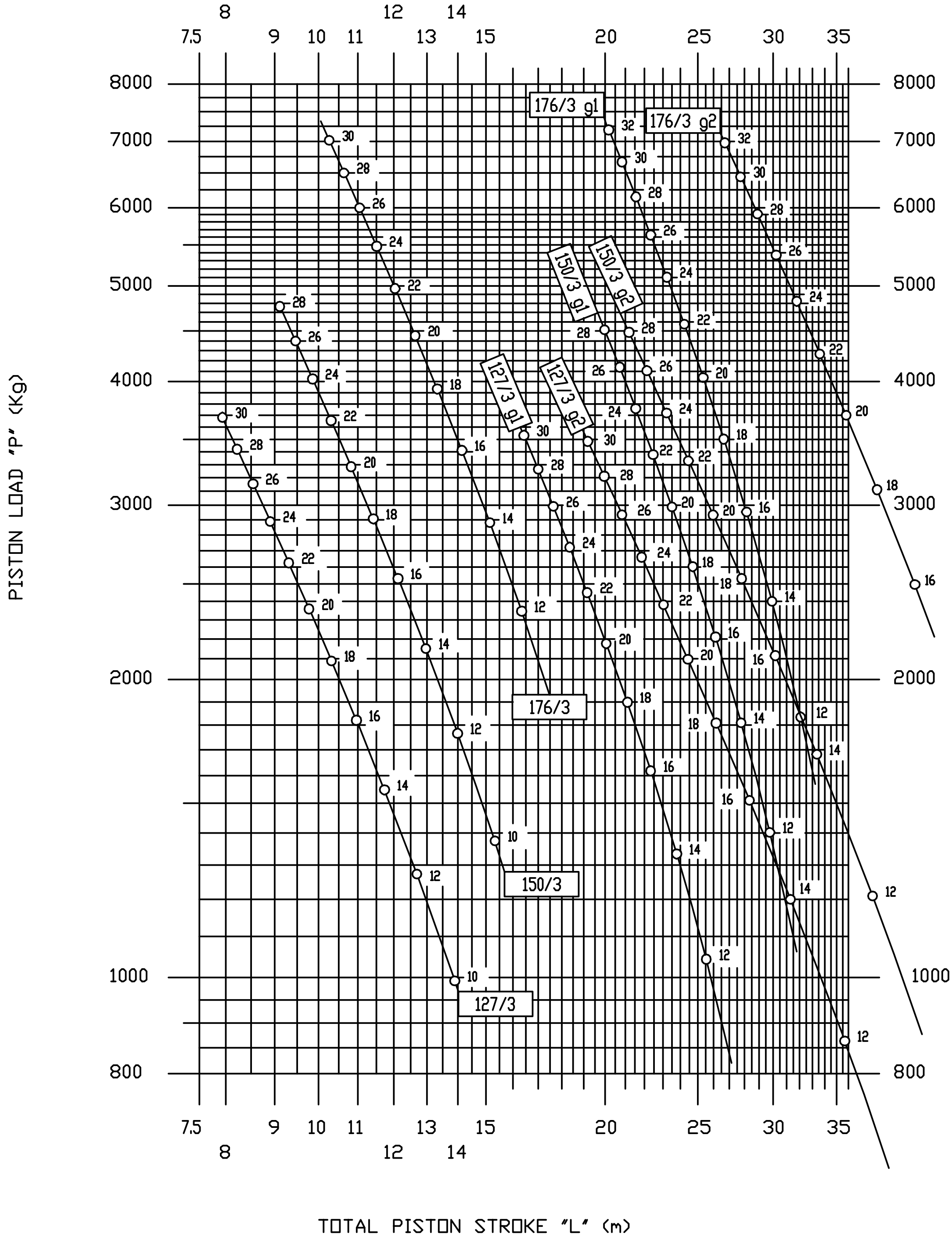
UT		

DIAGRAM OF THE PEAK LOADS GUIDELESS TELESCOPIC PISTONS WITH THREE EXTRACTORS (TYPE: 58/3 - 75/3 - 98/3 - 107/3)

(OVERPRESSURE FACTOR 1.4)

DATE 08/99

DWG N. 9603/10



UT		

DIAGRAM OF THE PEAK LOADS GUIDELESS TELESCOPIC PISTONS WITH THREE EXTRACTORS (TYPE 127/3 - 150/3 - 176/3)

(OVERPRESSURE FACTOR 1.4)

DATE 08/99

DWG N. 9603/20

9603/20-IN

_ 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 mm^2	Ap mm^2	i mm	J mm^4	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

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	D_i	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	S_1	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	C_5	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	D_A	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	D_I	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	D_f	-	-	123	123	123	142	151	173	173	186	209	230	257	282	339		
O-RING SEAT DIAMETER	D_o	-	-	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	D_B	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	P_1	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	P_3	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	P_5	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	P_6	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	P_7	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	P_8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	68.7	71.6
CALCULATION CYLINDER CONNECTION	P_9	-	-	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) ▨

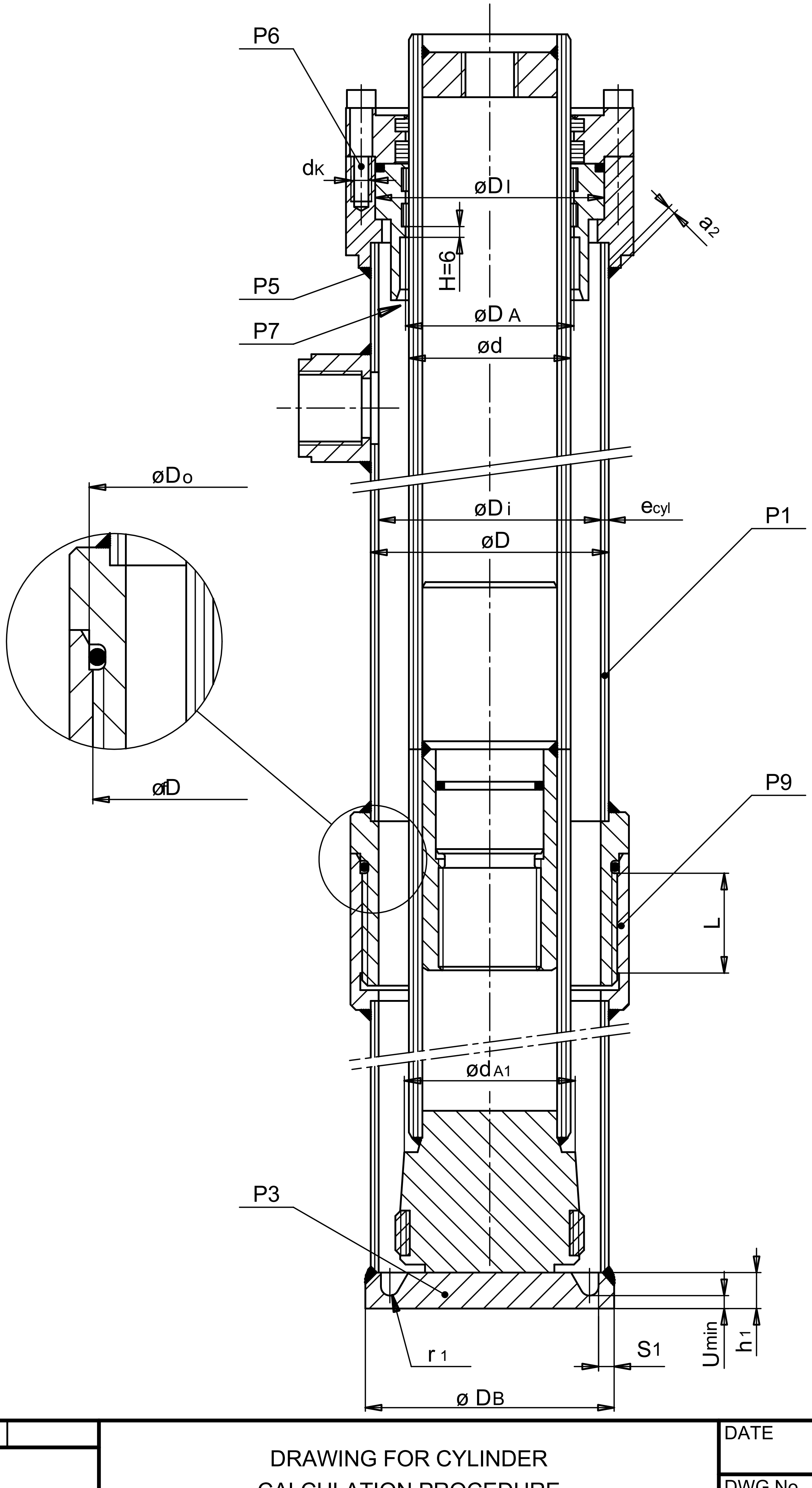
* Fe520 Rp0.2 = 355 N/mm2 YELD TENSION MATERIAL CYLINDRE
Fe370 Rp0.2 = 235 N/mm2 YELD TENSION MATERIAL BASE
Fe370 Rp0.2 = 235 N/mm2 YELD TENSION MATERIAL FEED PIPE
Fe370 Rp0.2 = 98 N/mm2 RESISTANCE TO SHEARING STRESS RAM HEAD

UT

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

DATE 12/07

DWG No 9041/1



UT

DRAWING FOR CYLINDER
CALCULATION PROCEDURE

DATE
05/02

DWG No
9041/2

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 81.2:99.**
- 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 81.2:99**

1) CYLINDER PIPE THICKNESS CALCULATION FOR DETERMINING THE INNER PRESSURE

- CALCULATION IS MADE IN COMPLIANCE WITH ANNEX K OF **UNI-EN 81.2:99** 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 ………………………………………………..**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 **TRA 200/229.11** **P =** 2,3 x 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 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 05/02

DWG N **9041/3**

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

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

- 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 81.2** **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 81.2:99** 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**

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

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

UT			CYLINDER CALCULATION PROCEDURE	DATE 05/02
				DWG N **9041/4**

- ACTUAL FORCE ON THE WELDING

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

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

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

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

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** $\mathbf{R}_{P0.2}$ = **640 N/mm^2**
- ACTUAL FORCE ON THE SCREWS :

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

- MIN. NEEDE BOLT DIAMETER:

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

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

n = SCREWS NUMBER

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

FOR:

Y <= 20 **C5** = 3

Y >= 50 **C5** = 1

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

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

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

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 81.2:99** 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 ………………$\mathbf{R}_{P0.2} = 235\ \text{N/mm}^2$
- BREAKING PERCENTAGE ELONGATION …. **A5 =** 25%
- FROM **DIN 2413** SI HA:

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

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

  $\mathbf{e_o = 0{,}5}$

- FROM **DIN 2413** $\mathbf{\eta_n} = 1$

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

- 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……………………………………… $\mathbf{R}_{P0.2} = 235\ \text{N/mm}^2$
- BREAKING PERCENTAGE ELONGATION ……… **A5** = 25%
- WELDINGS CALCULATION ISNT'T NECESSARY; SEE POINT **3** (DRAWING N. 9041/4)

THREAD CALCULATION

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

$$\frac{R_{P0.2}}{S} = \frac{2 \times F}{L \times \pi \times Df}$$

- WITH:

L = THREAD LENGTH

Df = THREAD DIAMETER

S = SAFETY FACTOR = 1,5

$R_{P0.2}$ = YIELD TENSION MATERIAL

F = TENSILE FORCE

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

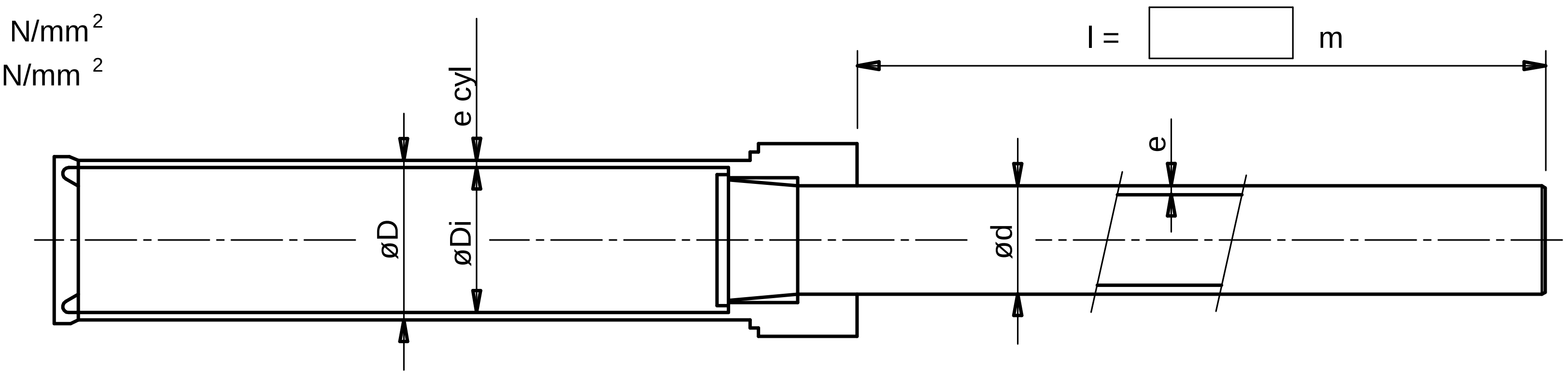
- REPLACING THE VALUES AND SOLVING WITH RESPECT TO P_{max} , SI HA:

$$P9_{max} = \frac{2 \times R_{P0.2} \times L \times Df}{2.3 \times 1.5 \times D_O^2} \times 10$$

UT			CYLINDER CALCULATION PROCEDURE	DATE 05/02
				DWG N **9041/7**

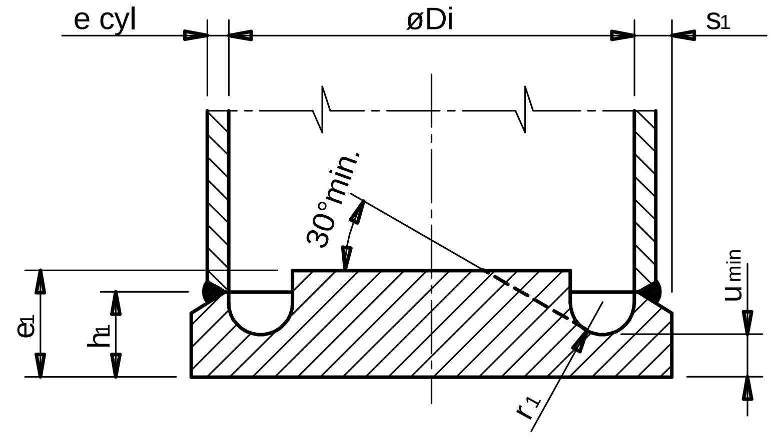
SIMPLE CYLINDER

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
Di		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	mm	x	x	x	x		x	x	x	x	x					
	6												x				
	7.5		x	x	x	x	x	x	x	x	x	x					
	10												x	x	x	x	
	12					x		x	x	x	x	x					
	14																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	mm^2	706.9	863.9	1021.0	1178.1		1335.2	1492.3	1649.3	1806.4	1963.5					
	6												2714.3				
	7.5		1001.4	1237.0	1472.6	1708.2	1826.1	1943.9	2179.5	2415.1	2650.7	2886.3					
	10												4398.2	4712.4	5340.7	5969.0	
	12					2563.5		2940.5	3317.5	3692.64	4071.5	4448.5					
	14																9652.0
i	5	mm	16.01	19.53	23.05	26.58		30.10	33.63	37.17	40.70	44.23					
	6												50.96				
	7.5		15.26	18.75	22.26	25.77	27.53	29.29	32.81	36.34	39.86	43.39					
	10												49.62	53.15	60.21	67.27	
	12					24.41		27.90	31.40	34.92	38.42	41.93					
	14																79.35
J	5	mm^4	181132	329376	542416	832031		1210004	1688115	2278146	2991876	3841088					
	6												7047774				
	7.5		233134	434884	729408	1134379	1383804	1667468	2346346	3188686	4212158	5434434					
	10												10830641	13312499	19360065	27009843	
	12					1527870		2289203	3271077	4501764	6009540	7822679					
	14																62033336
γ	5	Kg/m	5.5	6.7	7.9	9.2		10.4	11.7	12.9	14.1	15.3					
	6												21.2				
	7.5		7.8	9.6	11.5	13.3	14.3	15.2	17.1	18.9	20.7	22.5					
	10												34.4	36.8	41.7	46.6	
	12					20.0		23.0	25.9	28.9	31.8	34.7					
	14																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
γ = MASS OF THE RAM

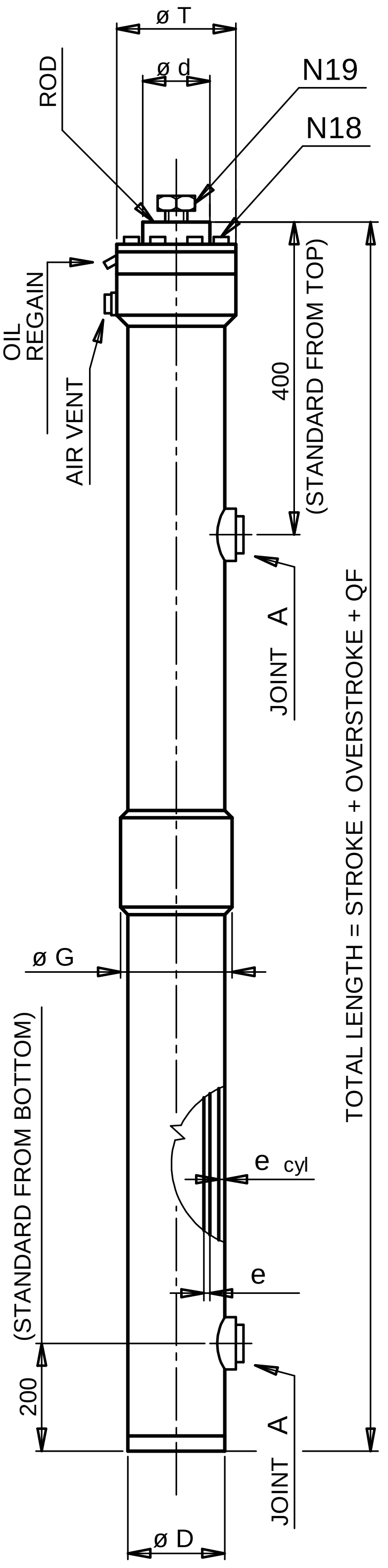
UT

INITIAL DATA FOR
CYLINDER - PISTON GROUP
- "HARMONISED STANDARDS UNI EN 81.2: 1999" -

DATE
12/07

DWG No
9041/S

ROD ød	A	N18	N19	Q F	øT	øG	e cyl	øD	OIL lxm	WEIGTH Kg 1 m Additional	WEIGTH Kg 3 m on Stroke	WEIGTH Kg Kit Joints Rod + Cylinder	e
50	SEE HYDRAULIC POWER UNIT	M10x45	M24x70 Ch=36	200	133	/	3.6	101.6	7	16	64	-	7.5
										15	60	-	5
60			M30x60 Ch=46	200	133	/	3.6	101.6	7	19	71	-	7.5
										16	64	-	5
70				200	140	133	4	114.3	9	23	84	10	7.5
										20	75	11	5
80				200	150	133	4	114.3	9	31	110	10	12
										25	91	12	7.5
										21	79	13	5
85				200	150	133	4	114.3	9				
										26	94	13	7.5
90				200	160	155	4.5	133	12	38	134	14	12
										30	109	16	7.5
										26	96	17	5
100		M12x45		200	174	166	4.5	139.7	13.5	42	150	18	12
										33	122	21	7.5
										28	107	23	5
110				215	180	190	5	159	17.5	49	175	23	12
										39	144	26	7.5
										33	126	29	5
120				215	190	190	5	159	17.5	52	186	26	12
										41	152	34	7.5
										34	131	37	5
130				215	202	202	5.6	177.8	22	59	214	36	12
										47	175	42	7.5
										40	153	45	5
150		M14x55		215	240	228	5.9	193.7	26	63	236	61	10
										50	194	66	6
160			M60 x p. 3.5 L=120 Ch=80	260	242	249	8	219.1	32.5				
										79	309	70	10
180		M16x65		260	270	278	8	244.5	41				
										90	357	100	10
200		M18x70		260	297	304	10	273	50				
										113	444	134	10
▨ 238				260	354	368	12.5	323.9	69				
													14



▨ 238 — FOR DIMENSIONING, PLEASE CONTACT OUR TRADE OFFICE

-NB.: FOR DIFFERENT HEIGHT (> 150 mm) OF JOINT "A" FROM BOTTOM, SPECIFY IN THE ORDER.

-FULLY EXTENDED RAM WITH TOP SLOWING BUFFER 35 mm.

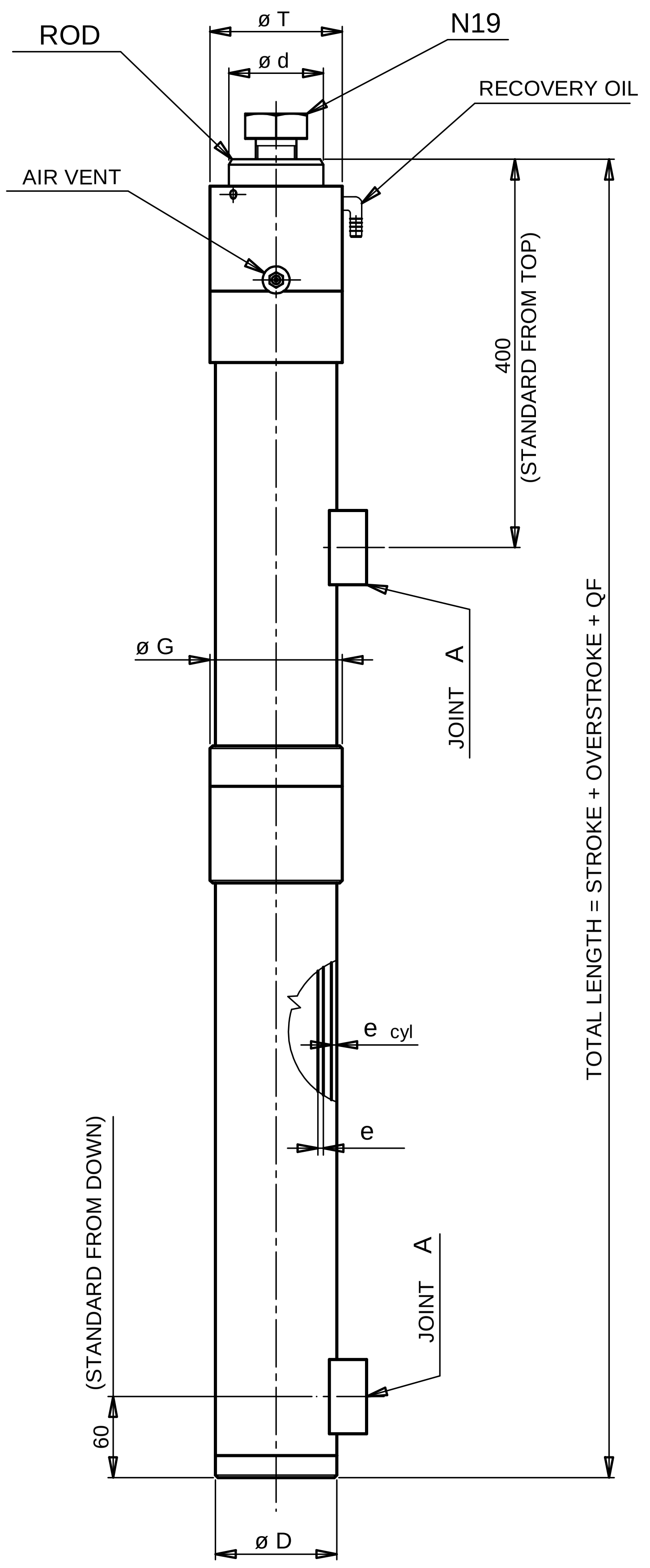
UT

INDIRECT SIDE RAM

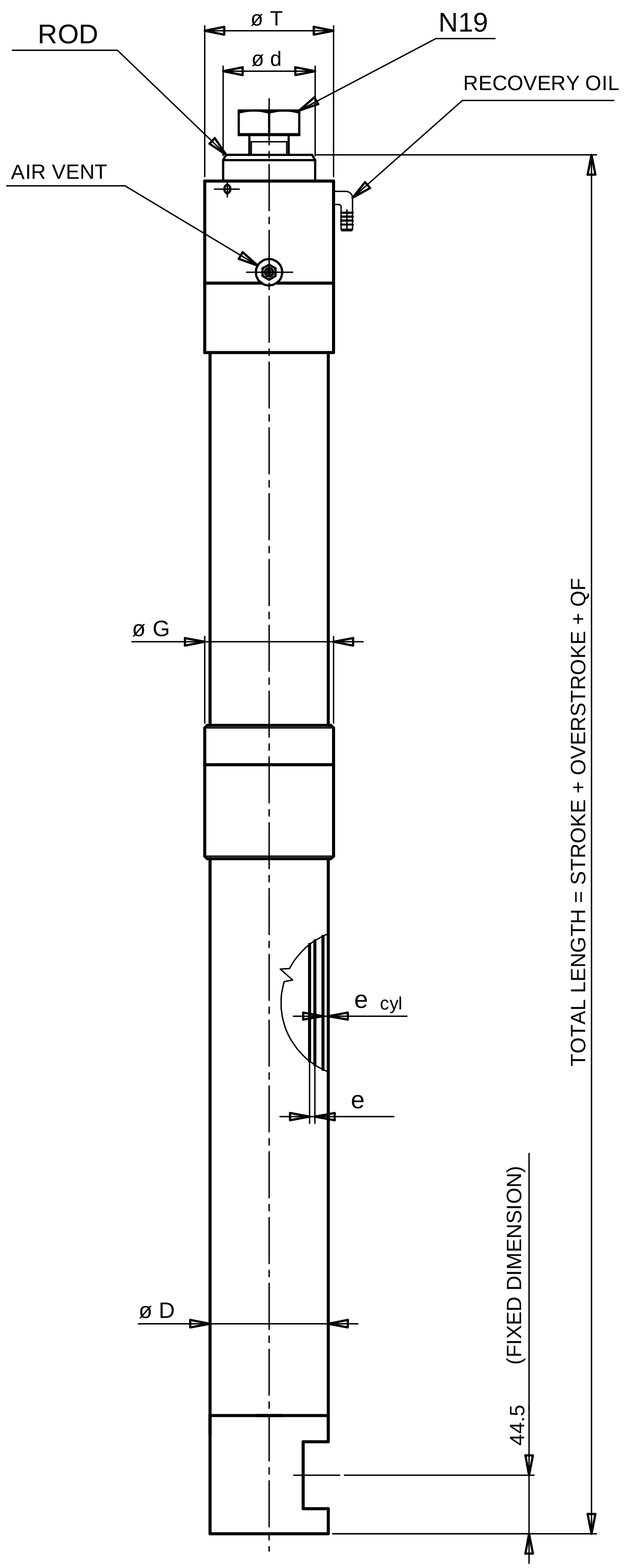
DATE 02/12

DWG Nr 9130

A		SEE HYDRAULIC POWER UNIT				
N19		T.E. M24x70 Ch. 36 T.E. M30x60 Ch. 46				
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		
OIL lxm		5.5		7		
WEIGTH Kg	1 m additional	17	20	18	22	29
	3 m of stroke	60	70	65	76	95
	Kit gaskets rod + cylinder	9	8	11	10	8
e		5	7.5	5	7.5	12
ROD ød		70		80		



VERSION 1
(Type: MCS)



VERSION 2
(Type: MCE)

NOTE:

- FOR RUPTURE VALVE DIMENSIONS, SEE DWG 9305 (Chapter 9)

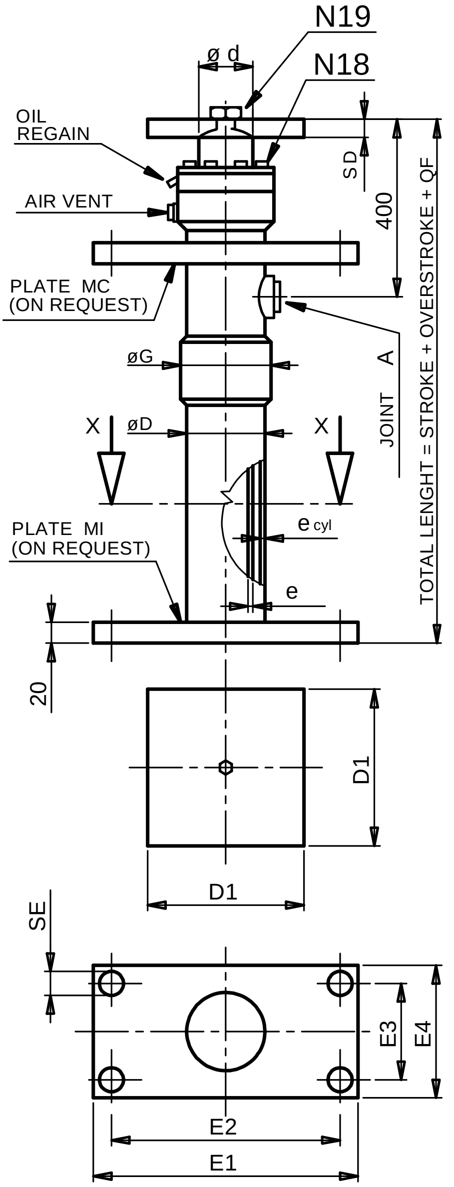
UT

ROPING 2:1
FOR ELEVATOR PLATFORM

DATE
01/13

DWG Nr
9131/MCE-MCS

A	N18	N19	Q F	øG	e cyl	øD	OIL lxm	WEIGHT Kg: 1 m Additional	WEIGHT Kg: 3 m on Stroke whith oscillating plate	WEIGHT Kg: Kit Joints Rod + Cylinder	WEIGHT Kg: MI plate on request	e	ROD ød
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

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

-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 (ON REQUEST)

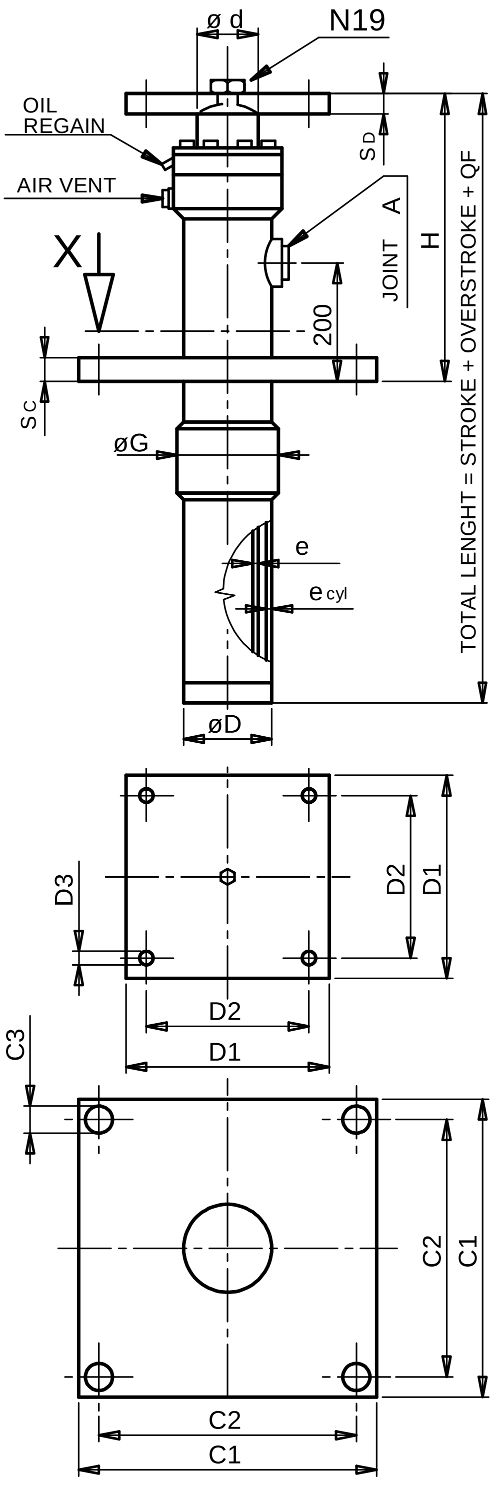
UT

DIRECT SIDE ACTING 1 : 1 RAM

DATE 02/12

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	368	12.5	323.9	69				14	▨ 238
			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

▨ 238 — FOR DIMENSIONING PLEASE CONTACT OUR TRADE OFFICE

-ROD UPPER PLATE IS OF OSCILLATING TYPE
-FULLY EXTENDED RAM WITH TOP SLOWING BUFFER 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

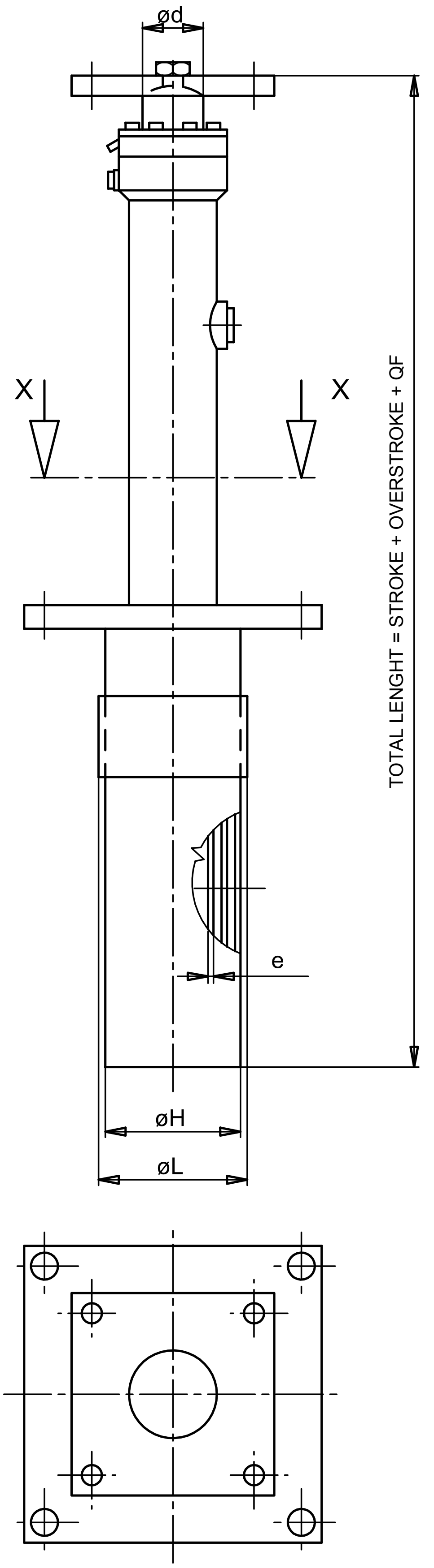
UT

DIRECT UNDERGROUND 1 : 1 RAM

DATE
01/13

DWG Nr
9150

Q F	øL	øH	WEIGHT Kg		e	ROD ød
			1 m	4 m		
295	155	133	31 28	164 152	7.5 5	60
295	175	152	44 40	205 190	7.5 5	70
295	175	152	31 25 22	158 132 120	12 7.5 5	80
295	175	152	26	136	7.5	85
295	200	177.8	38 30 27	188 157 145	12 7.5 5	90
295	200	177.8	69 60 54	340 304 280	12 7.5 5	100
310	220	193.7	50 40 34	264 225 202	12 7.5 5	110
310	220	193.7	58 47 41	302 258 230	12 7.5 5	120
320	245	219.1	65 53 45	343 295 265	12 7.5 5	130
330	270	244.5	124 112	618 568	10 6	150
340	293	267	148	722	10	160
390	322	298.5	172	848	10	180
390	365	323.9	205	985	10	200
410	457	406.4	330	1465	14	▨ 238



SEC. X-X

-NOTE: FOR ALL OTHER MEASUREMENTS SEE DWG N°9130

FULLY EXTENDED RAM WITH TOP BUFFER 35 mm

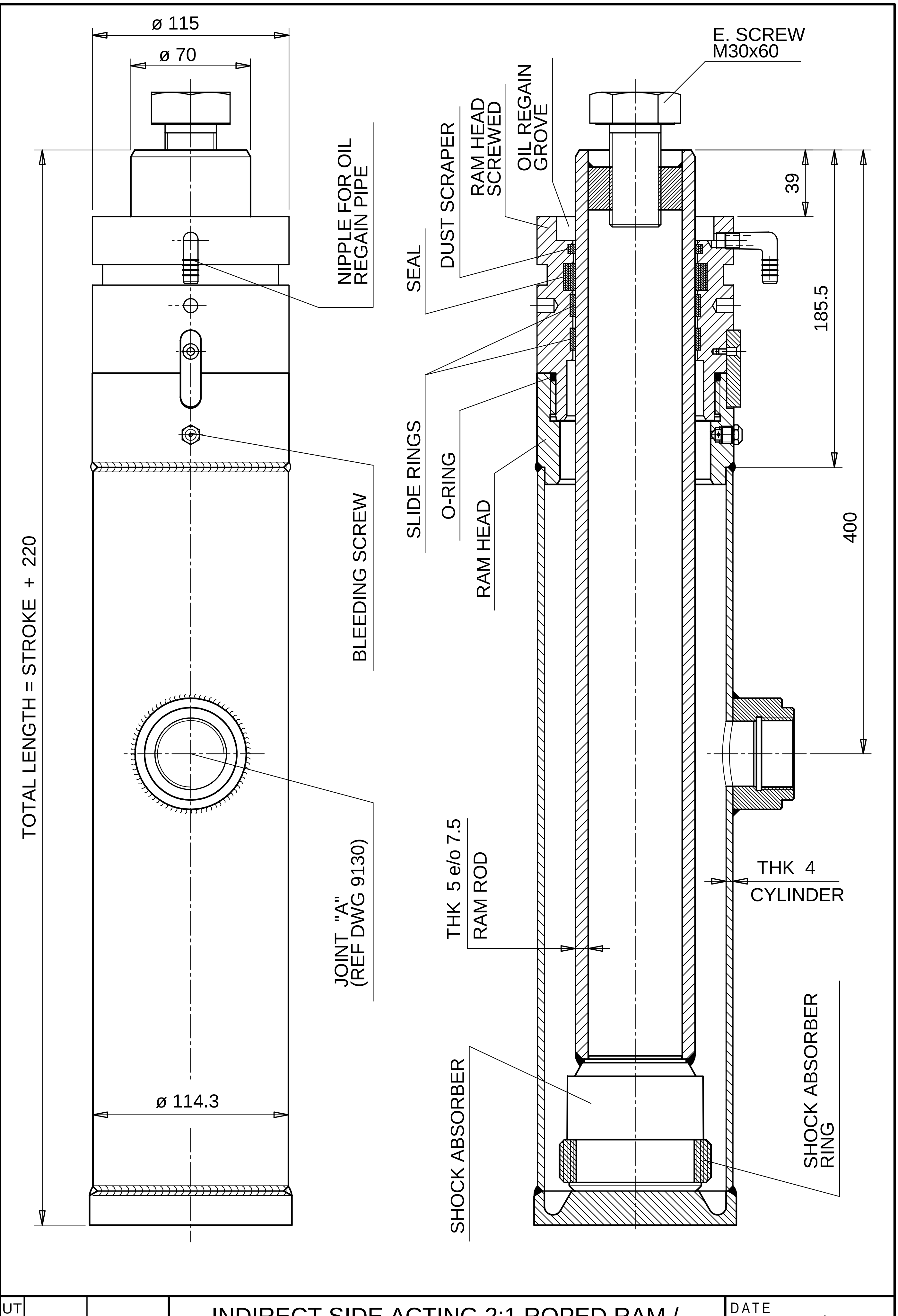
▨ 238 – FOR DIMENSIONING, PLEASE CONTACT OUR TRADE OFFICE

UT

DIRECT UNDERGROUND 1:1 RAM
WITH DOUBLE CYLINDER

DATE 10/01

DWG N. 9160



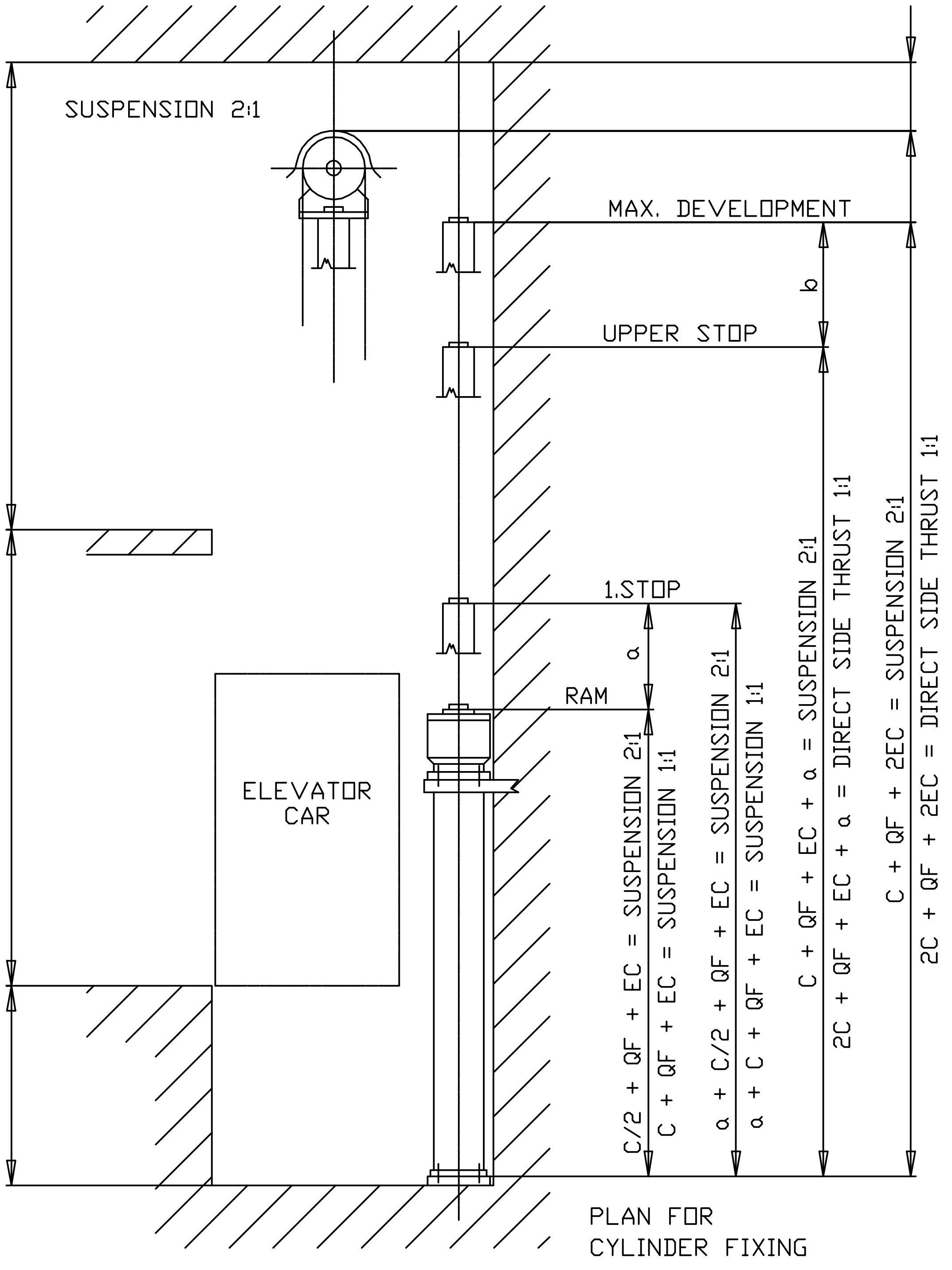
UT

INDIRECT SIDE ACTING 2:1 ROPED RAM /
DIRECT SIDE 1:1 RAM
WITH RAM HEAD REDUCED (70 DIA RAM ROD)

DATE 04/07

DWG Nr. 9162

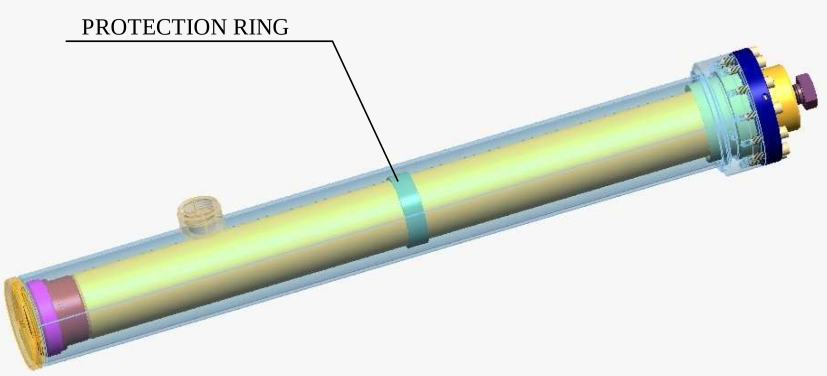
9162-IN



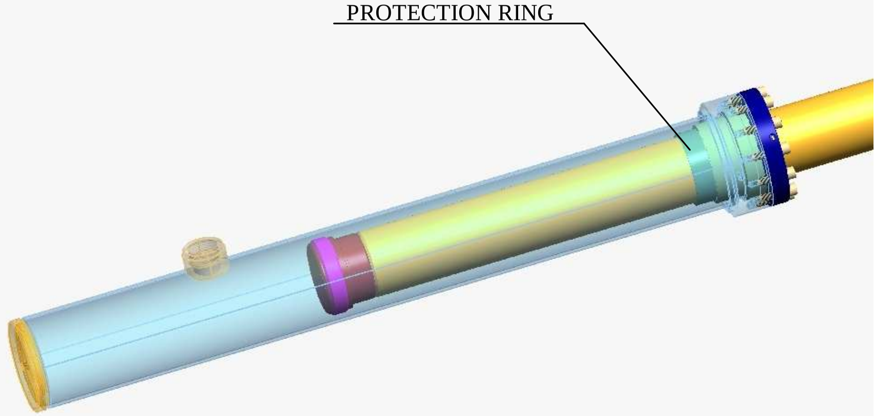
C : STROKE

EC : EXTRA STROKE (a+b)

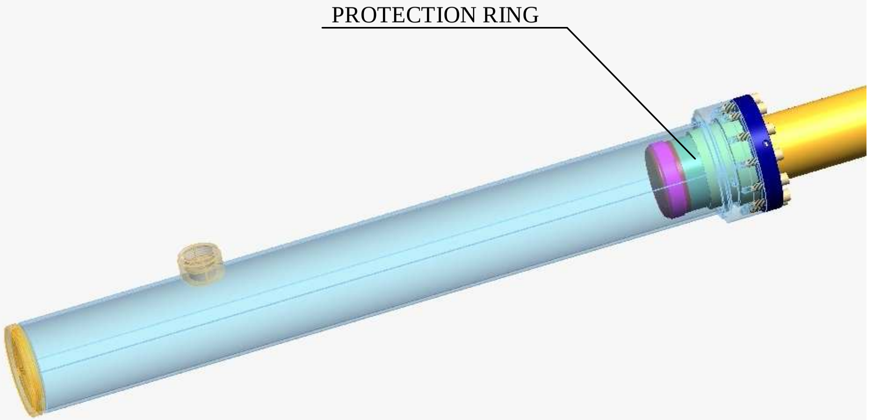
	SIDE RAM	DATE 04/90 DWG N. 9315



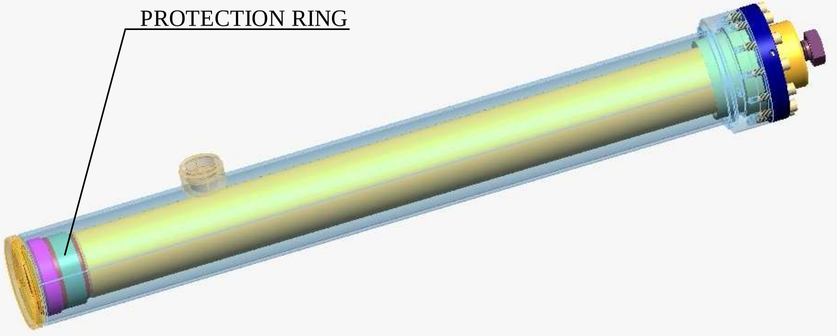
PHASE 1: PROTECTION RING POSITIONED BY MORIS ON THE MIDDLE OF THE ROD, TO SAFEGUARD IT FROM FORTUITOUS HITS AGAINST THE CYLINDER DURING TRANSPORTATION.



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.

UT

PROTECTION ROD SYSTEM
FOR TRANSPORT

DATE 02/10

DWG Nr. 9330/AT

9330/AT- ING