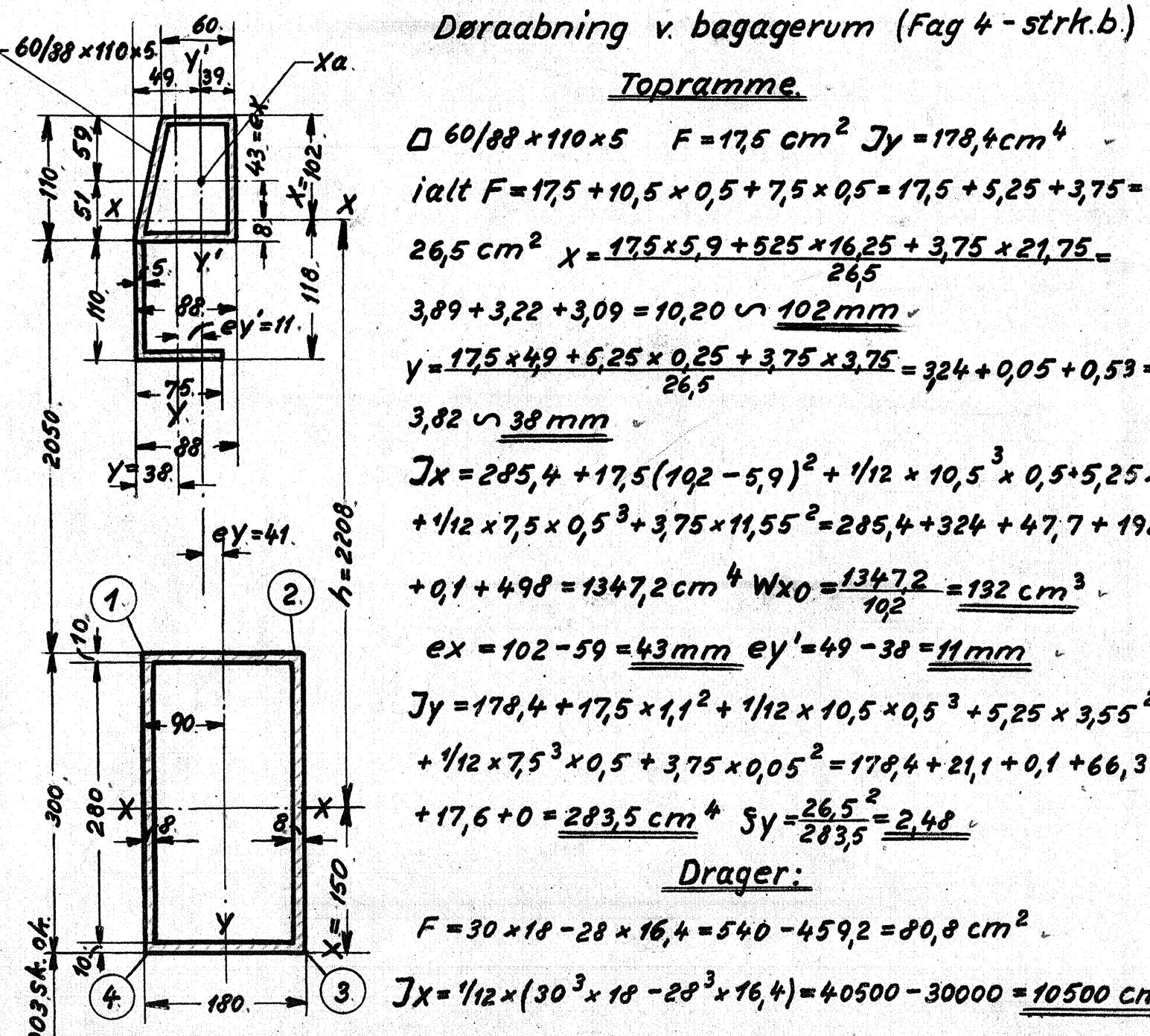
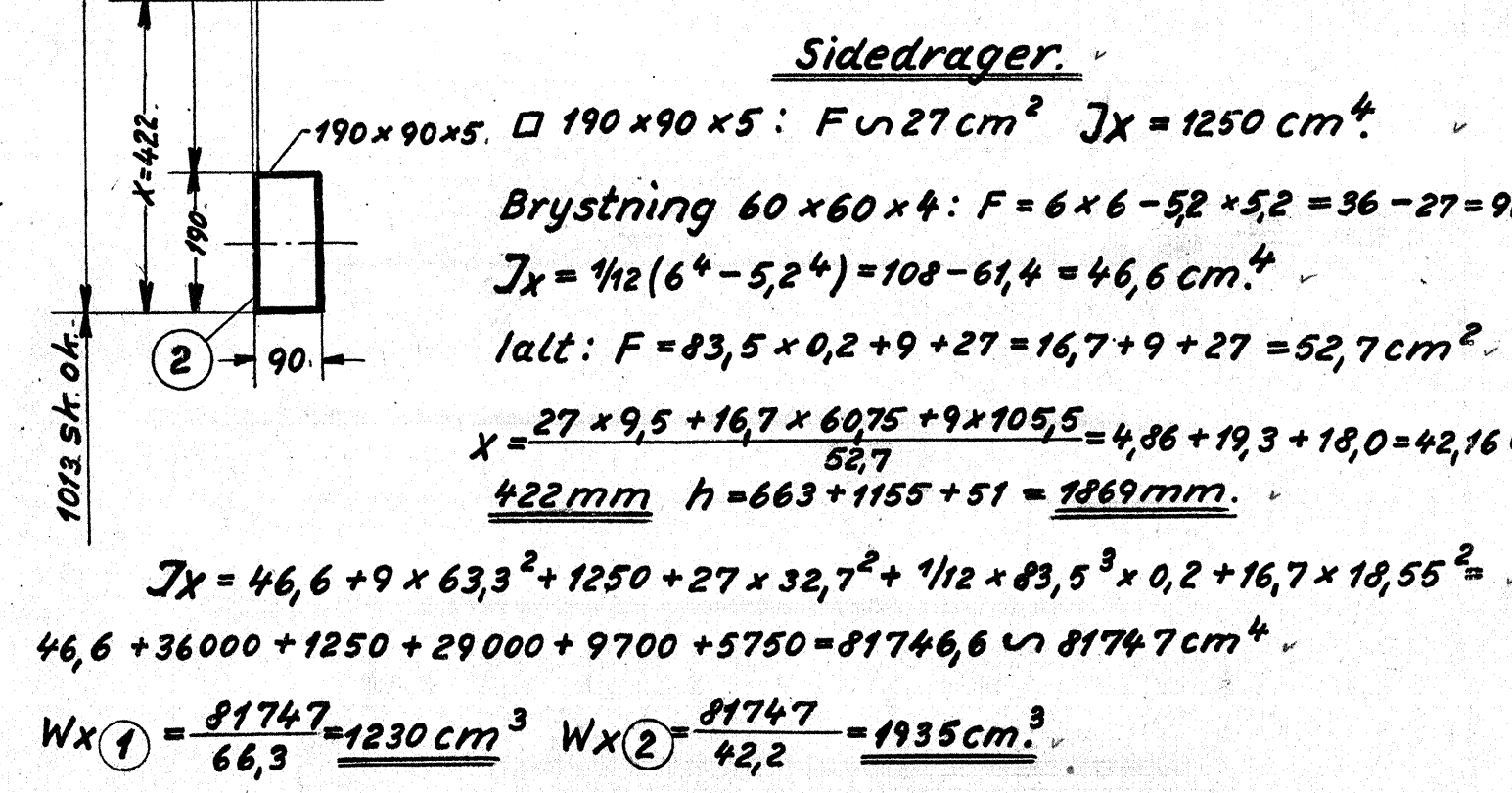
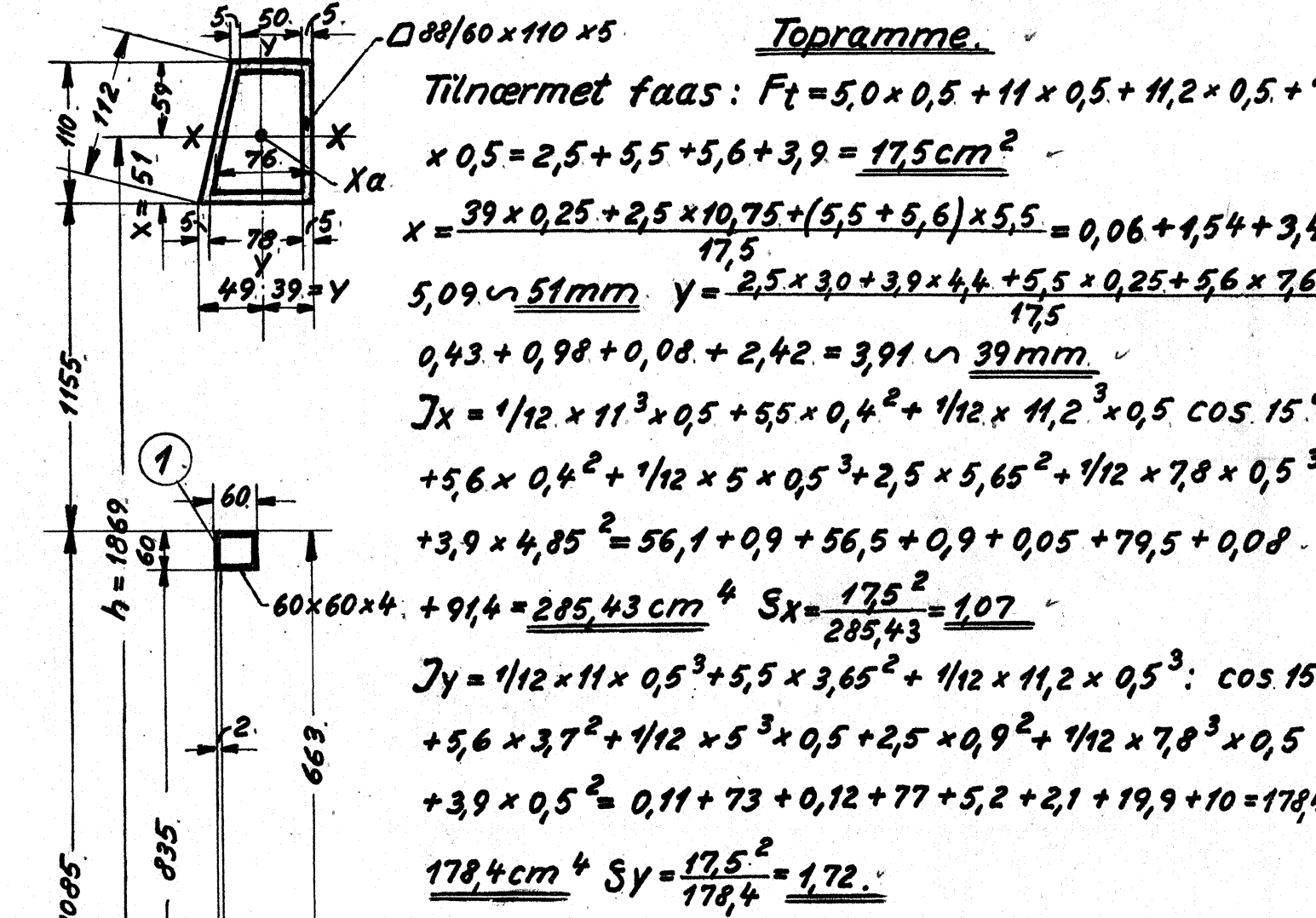
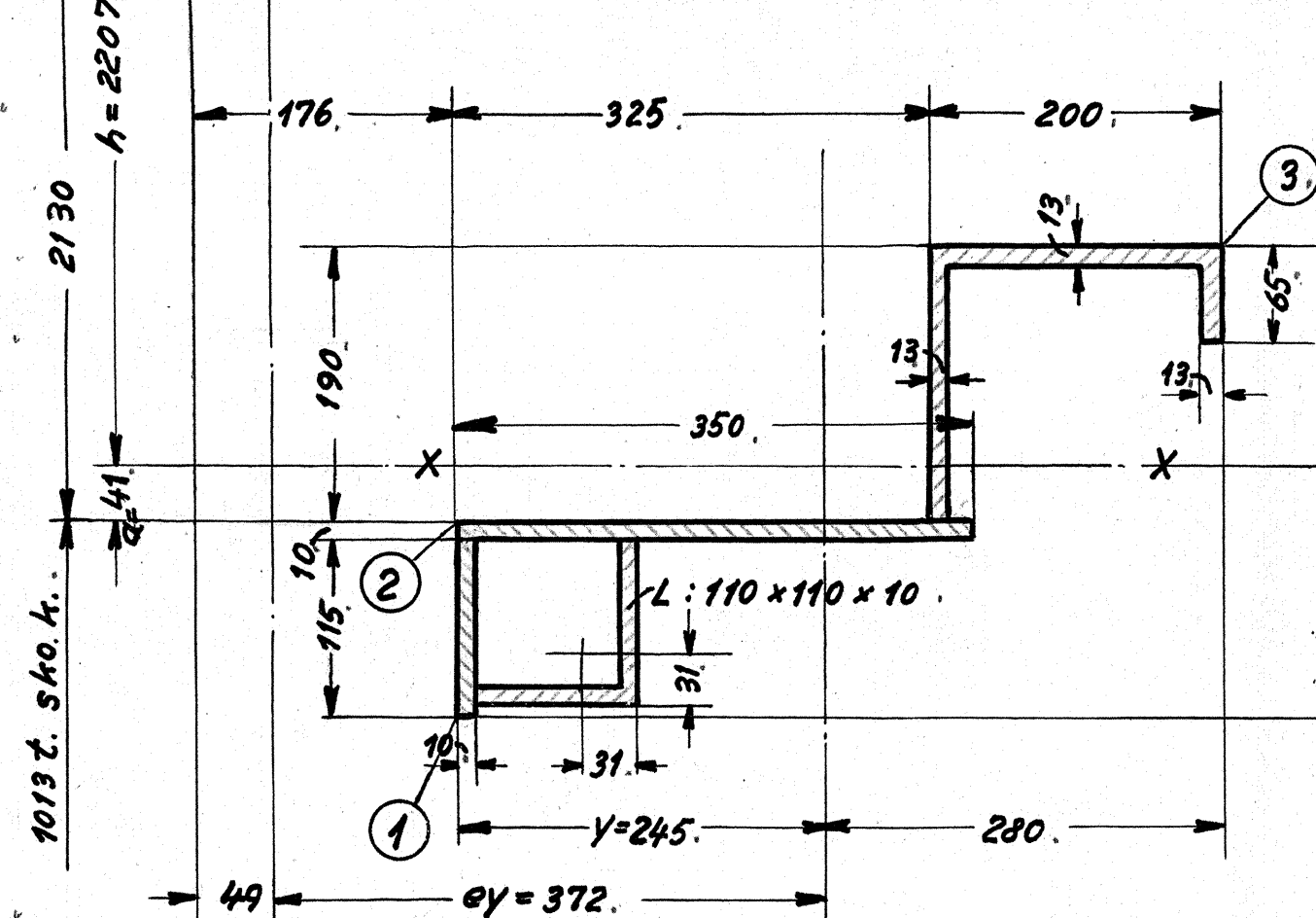
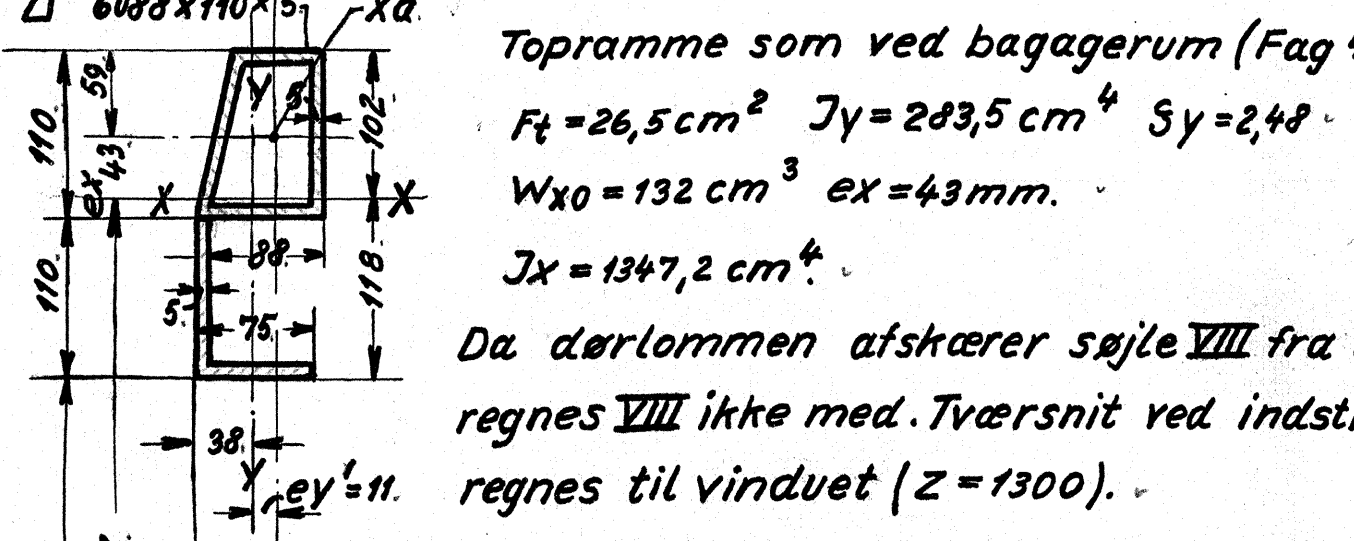


Tværsnit i Fag: 2, 3, 7, 10, 11 og 12, samt strækninger a og c i 4, d og fi 5, g og i i 6 og k og mi 8-9.



$W_x = 10500 : 15 = 700 \text{ cm}^3$
 $J_y = \frac{1}{12} (18^3 \times 30 - 16,4^3 \times 28) = 14580 - 10292 = 4288 \text{ cm}^4$
 $W_y = 4288 : 9 = 476,4 \text{ cm}^3$
 $h = 2050 + 150 + 8 = 2208 \text{ mm}$ $e_y = 90 - 49 = 41 \text{ mm}$

Døraabning ved indstigning (Fag 8-9 strk. L)



Da dørlommen afskærer søjle VIII fra dragere, regnes VIII ikke med. Tværsnit ved indstigning regnes til vinduet (Z=1300).

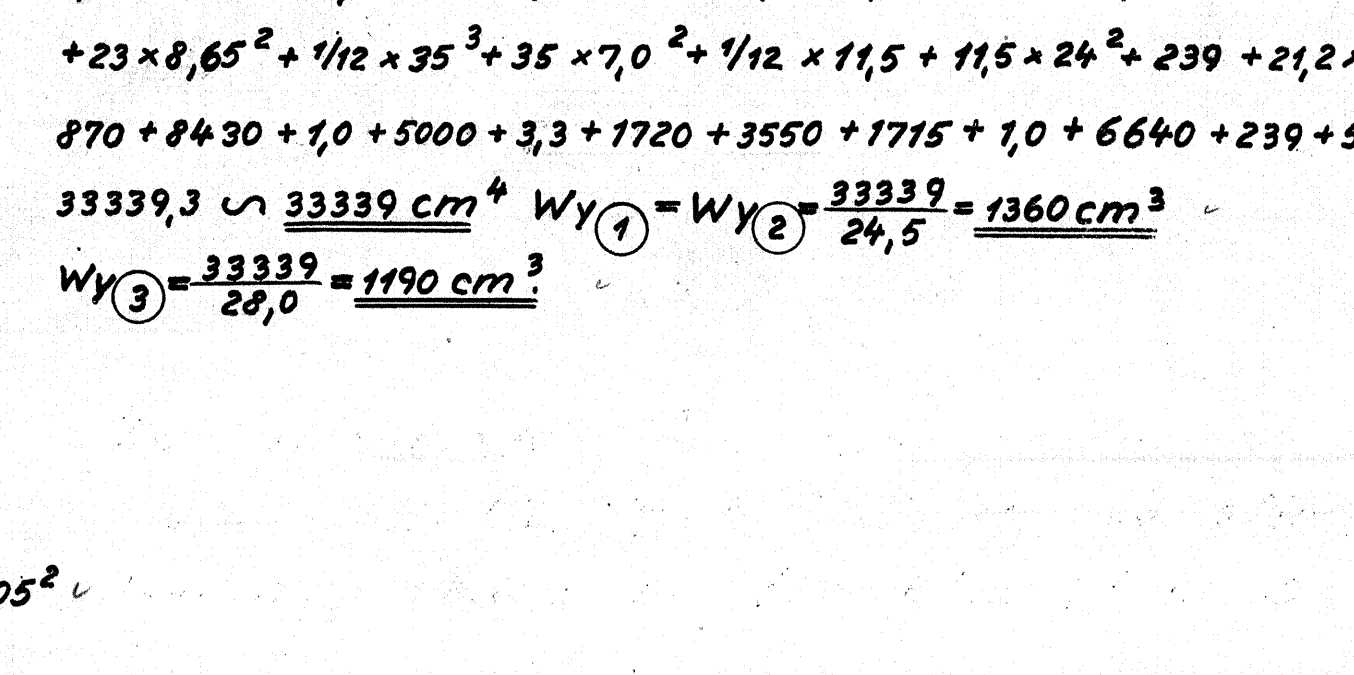
Sidedrager (8-9 strk. L)

$F = 20 \times 1,3 + 5,2 \times 1,3 + 17,7 \times 1,3 + 35 \times 1,0 + 11,5 \times 1,0 + 21,2 = 26 + 6,7 + 23,0 + 35,0 - 11,5 + 21,2 = 123,4 \text{ cm}^2$
 $x = \frac{26 \times 0,65 + 6,7 \times 3,9 + 23 \times 10,15 + 35 \times 19,5}{123,4} = 0,14 + 0,21 + 1,88 + 5,53 + 2,39 + 4,79 = 14,94 \text{ cm} \approx 149 \text{ mm}$
 $\alpha = 190 - 149 = 41 \text{ mm}$ $h = 1085 + 1155 - 41 + 8 = 2207 \text{ mm}$
 $y = \frac{26 \times 4,25 + 6,7 \times 5,185 + 23 \times 33,15 + 35 \times 17,5 + 11,5 \times 0,5 + 21,2 \times 89}{123,4} = 8,95 + 2,82 + 6,15 + 4,97 + 0,05 + 1,52 = 24,46 \text{ cm} \approx 245 \text{ mm}$
 $e_y = 245 + 176 - 49 = 372 \text{ mm}$
 $J_x = \frac{1}{12} \times 20 \times 1,3^3 + 26 \times 14,25^2 + \frac{1}{12} \times 5,2 \times 1,3^3 + 6,7 \times 11^2 + \frac{1}{12} \times 17,7^3 + 1,3 \times 23 \times 4,75^2 + \frac{1}{12} \times 35 \times 35 \times 4,6^2 + \frac{1}{12} \times 11,5^3 + 11,5 \times 10,85^2 + 239 + 21,2 \times 13^2 = 37,5 + 5270 + 15,3 + 810 + 604 + 520 + 2,9 + 741 + 126,5 + 1350 + 239 + 3580 = 13262,3 \text{ cm}^4$
 $W_x = \frac{13262}{176} = 75,35 \text{ cm}^3$
 $J_y = \frac{1}{12} \times 20^3 \times 1,3 + 26 \times 18,0^2 + \frac{1}{12} \times 5,2 \times 1,3^3 + 6,7 \times 27,35^2 + \frac{1}{12} \times 1,3^3 \times 17,7 + 23 \times 8,65^2 + \frac{1}{12} \times 35^3 + 35 \times 7,0^2 + \frac{1}{12} \times 11,5^3 + 11,5 \times 24^2 + 239 + 21,2 \times 15,6^2 = 870 + 8430 + 1,0 + 5000 + 3,3 + 1720 + 3550 + 1715 + 1,0 + 6640 + 239 + 5170 = 33339,3 \text{ cm}^4$
 $W_y = \frac{33339}{24,5} = 1360 \text{ cm}^3$
 $W_y = \frac{33339}{28,0} = 1190 \text{ cm}^3$

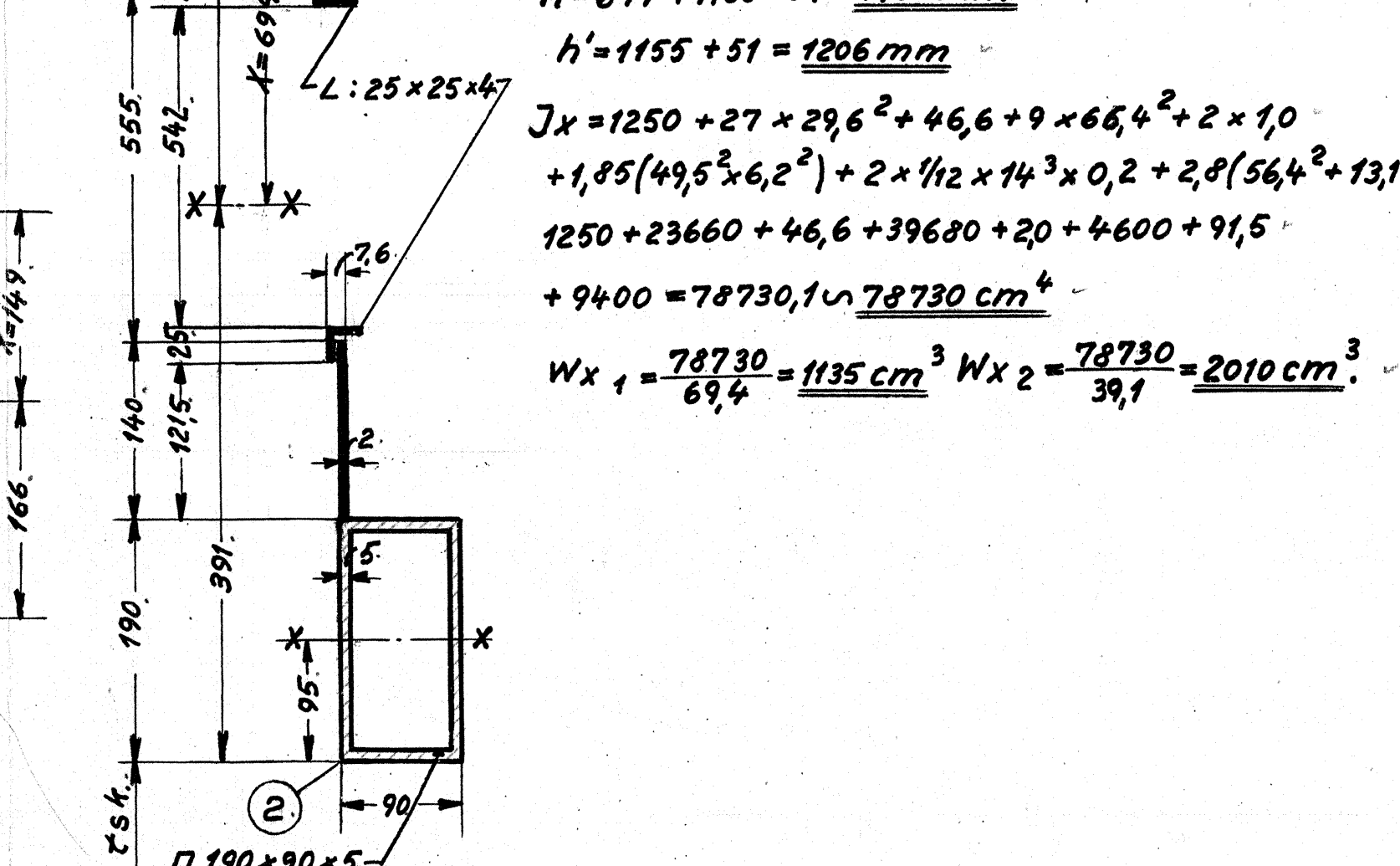
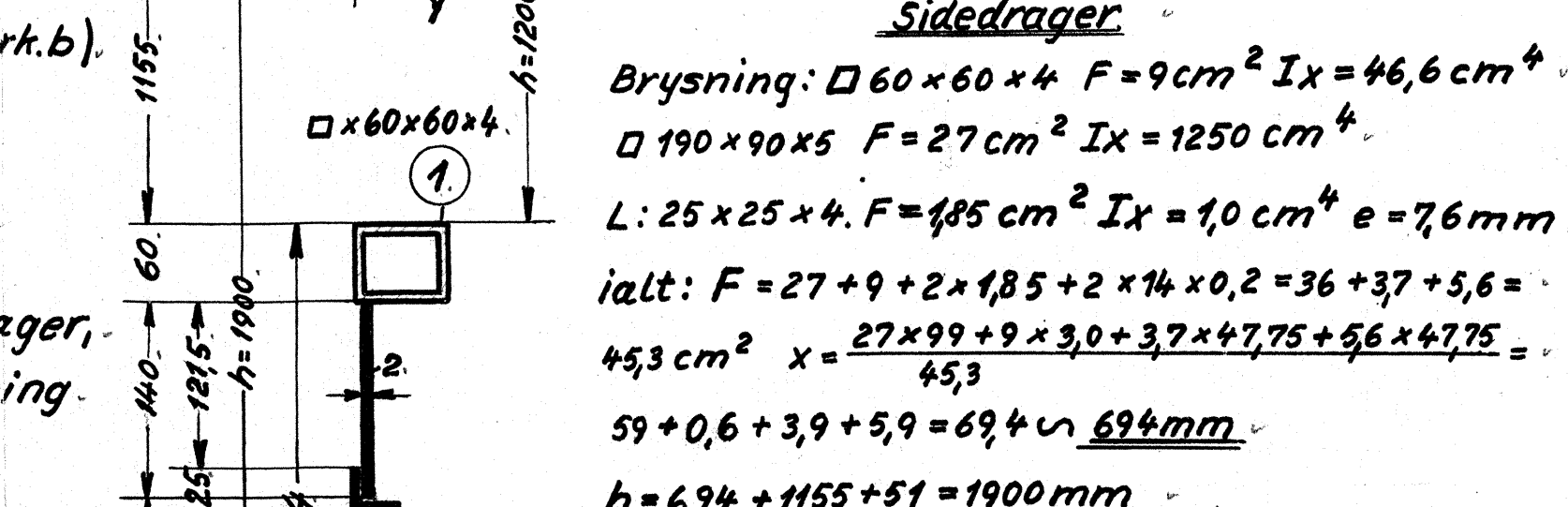
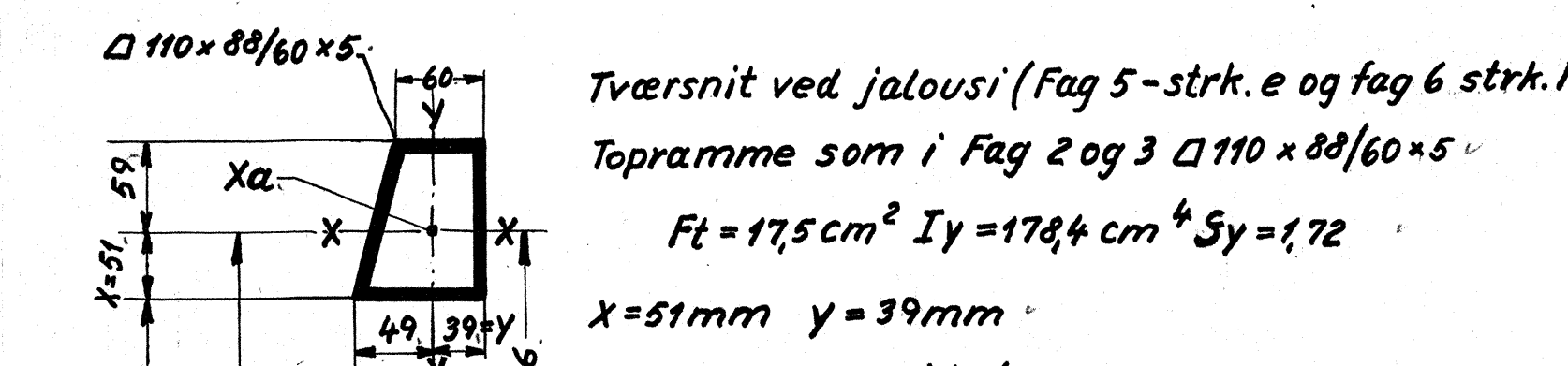
Da L 110 x 110 x 10 ikke kan skaffes er der anvendt L 100 x 100 x 12 i stedet, se efter beregning skitse nr. 18W-1.142-01 bl 03

$F = 6 \times 6 - 5,2 \times 5,2 = 36 - 27 = 9 \text{ cm}^2$
 $J_x = \frac{1}{12} (6^4 - 5,2^4) = 108 - 61,4 = 46,6 \text{ cm}^4$
 $I_{alt} = F = 83,5 \times 0,2 + 9 + 27 = 16,7 + 9 + 27 = 52,7 \text{ cm}^2$
 $x = \frac{27 \times 9,5 + 16,7 \times 6,075 + 9 \times 10,5}{52,7} = 4,86 + 19,3 + 18,0 = 42,16 \text{ cm} \approx 422 \text{ mm}$
 $h = 663 + 1155 + 51 = 1869 \text{ mm}$
 $J_x = 46,6 + 9 \times 63,3^2 + 1250 + 27 \times 32,7^2 + \frac{1}{12} \times 83,5^3 \times 0,2 + 16,7 \times 18,55^2 = 46,6 + 36000 + 1250 + 29000 + 9700 + 5750 = 81746,6 \text{ cm}^4 \approx 81747 \text{ cm}^4$
 $W_x = \frac{81747}{66,3} = 1230 \text{ cm}^3$ $W_x = \frac{81747}{42,2} = 1935 \text{ cm}^3$

Døraabning v. bagagerum (Fag 4 - strk. b)



$F = 60/88 \times 110 \times 5 = 175 \text{ cm}^2$ $J_y = 178,4 \text{ cm}^4$
 $I_{alt} F = 17,5 + 10,5 \times 0,5 + 7,5 \times 0,5 = 17,5 + 5,25 + 3,75 = 26,5 \text{ cm}^2$
 $x = \frac{17,5 \times 5,9 + 5,25 \times 16,25 + 3,75 \times 21,75}{26,5} = 3,89 + 3,22 + 3,09 = 10,20 \text{ cm} \approx 102 \text{ mm}$
 $y = \frac{17,5 \times 4,9 + 5,25 \times 0,25 + 3,75 \times 3,75}{26,5} = 3,82 + 0,05 + 0,53 = 4,4 \text{ cm} \approx 38 \text{ mm}$
 $J_x = 285,4 + 17,5 (192 - 5,9)^2 + \frac{1}{12} \times 10,5^3 \times 0,5 + 5,25 \times 6,05^2 + \frac{1}{12} \times 7,5^3 \times 0,5 + 3,75 \times 11,5^2 = 285,4 + 324 + 47,7 + 192 + 9,1 + 498 = 1347,2 \text{ cm}^4$
 $W_x = \frac{1347,2}{10,2} = 132 \text{ cm}^3$
 $e_x = 102 - 59 = 43 \text{ mm}$ $e_y = 49 - 38 = 11 \text{ mm}$
 $J_y = 178,4 + 17,5 \times 1,1^2 + \frac{1}{12} \times 10,5 \times 0,5^3 + 5,25 \times 3,55^2 + \frac{1}{12} \times 7,5^3 \times 0,5 + 3,75 \times 0,05^2 = 178,4 + 21,1 + 0,1 + 66,3 + 17,6 + 0 = 283,5 \text{ cm}^4$
 $S_y = \frac{283,5}{24,8} = 11,4 \text{ cm}$
 $F = 30 \times 18 - 28 \times 16,4 = 540 - 459,2 = 80,8 \text{ cm}^2$
 $J_x = \frac{1}{12} \times (30^3 \times 18 - 28^3 \times 16,4) = 40500 - 30000 = 10500 \text{ cm}^4$



Beregning af momentfladearealer:

Fag 2: Fo-e = $-\frac{1}{2} \times 2,44 \times 10^3 \times (102,9 + 129,9) - \frac{1}{2} \times 36 \times 10^3 \times (129,9 + 187,8) - \frac{1}{2} \times 70 \times 10^3 \times (187,8 + 314,8) + \frac{1}{2} \times 40 \times 314,8 \times 10^3 + \frac{1}{2} \times 5,7,3 \times 427,5 \times 10^3$
 $Fo-2 = -284,016 \times 10^4 - 574,86 \times 10^4 - 1759,1 \times 10^4 - 629,6 \times 10^4 + 1234,79 \times 10^4$
 $Fo-2 = (-3244,58 + 1234,79) \times 10^4 = -2009,8 \times 10^5 \text{ kg cm}^2$
Fag 3: Fo-3 = $\frac{1}{2} \times 51,5 \times 10^3 \times (427,5 + 797,6) + \frac{1}{2} \times 33,2 \times 10^3 \times (797,6 + 1022) + \frac{1}{2} \times 68,8 \times 10^3 \times (1022 + 1459,6) + \frac{1}{2} \times 28,2 \times 10^3 \times (1459,6 + 1628,7) + \frac{1}{2} \times 43,3 \times 10^3 \times (1628,7 + 1877,6) = (3154,6 + 3020,54 + 8536,70 + 4354,5 + 7561,1) \times 10^4 = 2662,74 \times 10^5 \text{ kg cm}^2$
Fag 4(a): Fo-4a = $\frac{1}{2} \times 38,7 \times 10^3 \times (187,6 + 2085,3) = 766,82 \times 10^5 \text{ kg cm}^2$
Fag 4(c): Fo-4c = $\frac{1}{2} \times 51,0 \times 10^3 \times (2586,3 + 2752,6) = 1360,00 \times 10^5 \text{ kg cm}^2$
Fo-4(a+c) = $(766,82 + 1360,00) \times 10^5 = 2126,82 \text{ kg cm}^2$
Fag 4(b): Fo-4b = $\frac{1}{2} \times 61,5 \times 10^3 \times (2085,3 + 2351,7) + \frac{1}{2} \times 61,5 \times 10^3 \times (2351,7 + 2586,3) = (13643,775 + 15184,35) \times 10^4 = 2882,81 \times 10^5 \text{ kg cm}^2$
Fag 5(d): Fo-5d = $\frac{1}{2} \times 32,5 \times 10^3 \times (2752,6 + 2853,2) + \frac{1}{2} \times 15,5 \times 10^3 \times (2853,2 + 2876,9) = (9120,00 + 4441,00) \times 10^4 = 1356,10 \times 10^5 \text{ kg cm}^2$
Fag 5(f): Fo-5f = $\frac{1}{2} \times 14,0 \times 10^3 \times (2900,4 + 2914,8) = 407,01 \times 10^5 \text{ kg cm}^2$
Fo-5(f+d) = $(1356,10 + 407,01) \times 10^5 = 1763,11 \times 10^5 \text{ kg cm}^2$
Fag 5e: Fo-5e = $\frac{1}{2} \times 35,0 \times 10^3 \times (2876,9 + 2900,4) = 1011,03 \times 10^5 \text{ kg cm}^2$
Fag 6(g): Fo-6g = $\frac{1}{2} \times 140 \times 10^3 \times (2914,8 + 2925,2) = 408,8 \times 10^5 \text{ kg cm}^2$
Fag 6i: Fa-6i = $\frac{1}{2} \times 16,5 \times 10^3 \times (2951,1 + 2962,1) = 488,0 \times 10^5 \text{ kg cm}^2$
Fo-6(g+i) = $(408,8 + 488,0) \times 10^5 = 896,80 \times 10^5 \text{ kg cm}^2$
Fag 6(h) = $\frac{1}{2} \times 35,0 \times 10^3 \times (2925,2 + 2951,1) = 1028,35 \times 10^5 \text{ kg cm}^2$

Fag 7: Fo-7 = $\frac{1}{2} \times 190 \times 10^3 \times (2962,1 + 2931,0) + \frac{1}{2} \times 53,0 \times 10^3 \times (2931,0 + 2845,2) + \frac{1}{2} \times 36,1 \times 10^3 \times (2845,2 + 2794,5) = (5590,00 + 15310,0 + 7350,00) \times 10^4 = 28250,00 \times 10^5 \text{ kg cm}^2$
Fag 8-9 (k): Fo-8-9k = $\frac{1}{2} \times 28,9 \times 10^3 \times (2794,5 + 2723,0) + \frac{1}{2} \times 48,5 \times 10^3 \times (2723,0 + 2595,3) + \frac{1}{2} \times 20,5 \times 10^3 \times (2595,3 + 2526,5) + \frac{1}{2} \times 70,5 \times 10^3 \times (2526,5 + 2263,8) = (7980,00 + 12896,8 + 5249,8 + 16885,8) \times 10^4 = 43012,40 \times 10^5 \text{ kg cm}^2$
Fag 8-9 (m): Fo-8-9m = $\frac{1}{2} \times 18,7 \times 10^3 \times (1701,1 + 1605,1) = 3090,2 \times 10^5 \text{ kg cm}^2$
Fo-8-9 (k+m) = $(4301,2 + 309,0) \times 10^5 = 4610,2 \times 10^5 \text{ kg cm}^2$
Fag 8-9 (L): Fo-8-9L = $\frac{1}{2} \times 65,0 \times 10^3 \times (2263,8 + 2001,7) + \frac{1}{2} \times 65,0 \times 10^3 \times (2001,7 + 1701,1) = (13862,875 + 12034,10) \times 10^4 = 25897,0 \times 10^5 \text{ kg cm}^2$
Fag 10: Fo-10 = $\frac{1}{2} \times 20,8 \times 10^3 \times (1605,1 + 1494,8) + \frac{1}{2} \times 97,0 \times 10^3 \times (1494,8 + 935,3) + \frac{1}{2} \times 36,5 \times 10^3 \times (935,3 + 705,0) = (3220,0 + 11809,0 + 2990,0) \times 10^4 = 1801,00 \times 10^5 \text{ kg cm}^2$
Fag 11: Fo-11 = $\frac{1}{2} \times 36,5 \times 10^3 \times (705,0 + 464,2) + \frac{1}{2} \times 66 \times 10^3 \times 464,2 - \frac{1}{2} \times 31,0 \times 10^3 \times 222,6 - \frac{1}{2} \times 19,0 \times 10^3 \times (222,6 + 365,9) - \frac{1}{2} \times 22,5 \times (365,9 + 319,4) = (2132,00 + 1531,86 - 345,03 - 559,075 - 769,00) \times 10^4 = 199,07 \times 10^5 \text{ kg cm}^2$
Fag 12: Fo-12 = $-\frac{1}{2} \times 31,5 \times 10^3 \times (319,4 + 257,4) - \frac{1}{2} \times 97,0 \times 10^3 \times (257,4 + 110) - \frac{1}{2} \times 29,9 \times 10^3 \times (111,0 + 79,4) = (-95,00 - 1790,0 - 284,0) \times 10^4 = -298,40 \times 10^5 \text{ kg cm}^2$

Stk.	Betegnelse	Pos.	Materiale kvalitet	Model nr. eller materiale størrelse	rå vægt	færdig vægt/stk.
		5				
		4				
		3				
		2				
		1				
Tegn. M.A. Rev. E.U.1-12-50. Ats. J.L. Kalk. B.F. 29/9-50. Norm. Dato			Målestok: 1:10 1:5			
Dato			Indeks			
Anvendelse			Stykliste nr.			
Diesel-el. motorvogn 500/550-Mo.						
Tegningens benævnelse			Tegningens nummer			
Beregning af vognside.			18W-1.142.			
Indeks:						