Certification Test Report

Morsø Jernstøberi A/S

Freestanding Wood Stove
Model: 6100 Series

Report Number: 192-S-15-3

OMNI-Test Laboratories, Inc.
Product Testing & Certification

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Certification Test Report

Morsø Jernstøberi A/S

Freestanding Wood Stove

Model: 6100 Series

Prepared for:	Morsø Jernstøberi A/S Furvej 6 7900 Nykøbing Mors Denmark
Prepared by:	OMNI-Test Laboratories, Inc. 5465 SW Western Avenue, Suite G Beaverton, OR 97005 (503) 643-3788
Test Period:	November 1, 2007 through November 2, 2007
Report Date:	November 2007
Report Number:	192-S-15-3

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AUTHORIZED SIGNATORIES

This report has been reviewed and approved by the following authorized signatories:

Alana Smith, Senior Manager
OMNI-Test Laboratories, Inc.

John Voorhees, Technical Services Director
OMNI-Test Laboratories, Inc.

Ken Morgan, Emissions Testing Technician
OMNI-Test Laboratories, Inc.

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Section 1

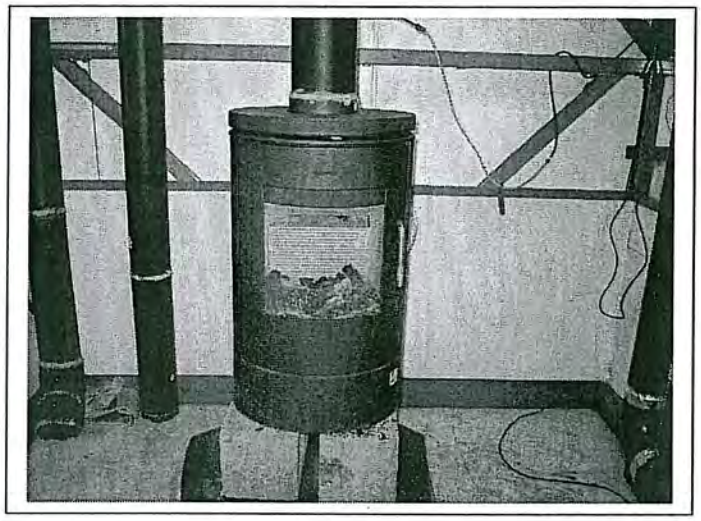
Fuel Photographs/Appliance Description/Drawings

Model: 6100 Series
Morsø Jernstøberi A/S
Furvej 6
7900 Nykøbing Mors
Denmark

Morsø Jernstøberi A/S

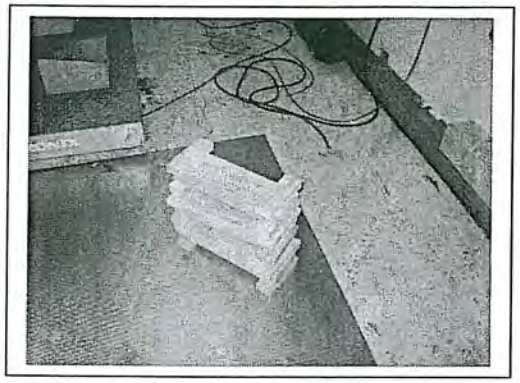
6100 Series

Test Dates: November 1, 2007 through November 2, 2007

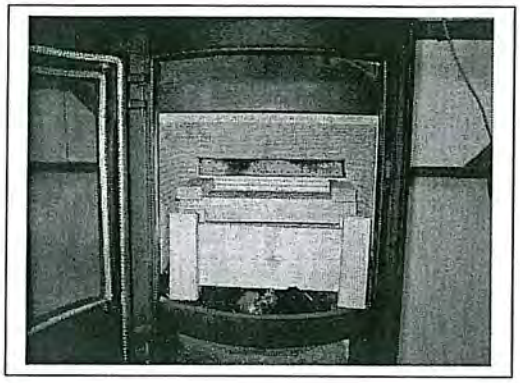


Morsø Jernstøberi A/S
6100 Series

Run 1 – Fuel



Run 1 – Newly Loaded Stove



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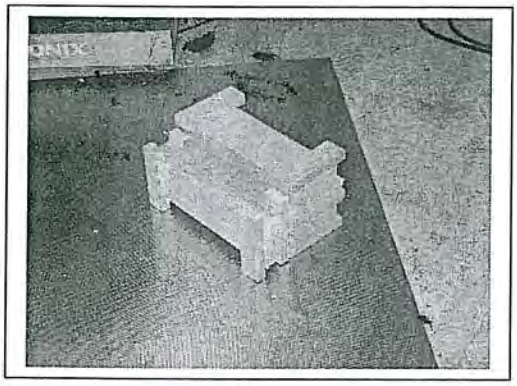
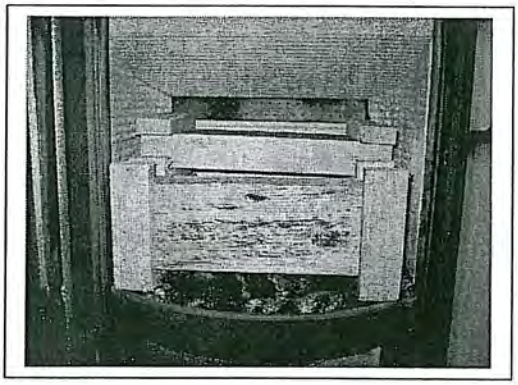
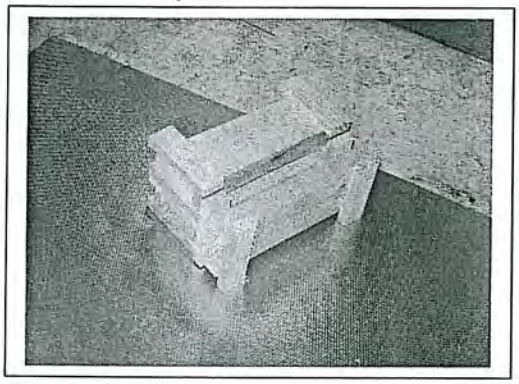


Run 2 – Newly Loaded Stove

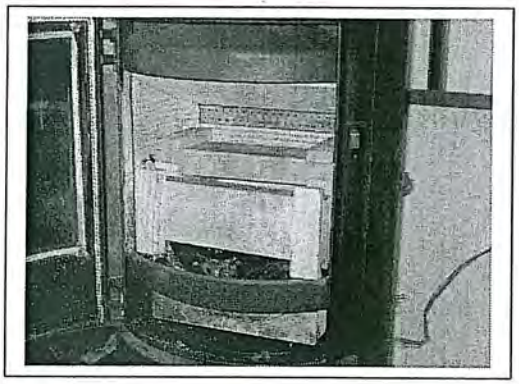


Morsø Jernstøberi A/S
6100 Series

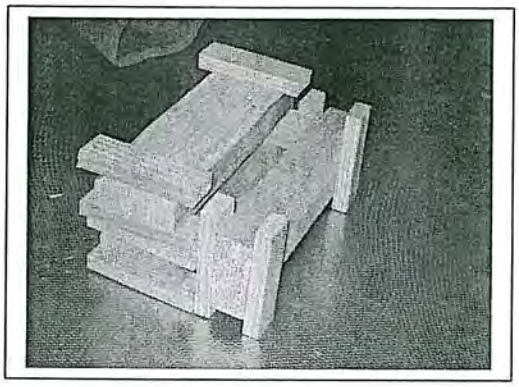
Run 3 – Fuel



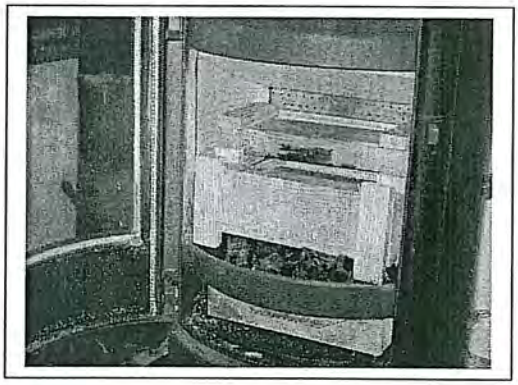
Run 3 – Newly Loaded Stove



Run 4 – Fuel



Run 4 – Newly Loaded Stove



WOOD HEATER DESCRIPTION

Appliance Manufacturer: Morsø Jernstøberi A/S

Wood Stove Model: 6100 Series

Type: Freestanding, radiant-type room heater

WOOD HEATER INFORMATION

Materials of Construction: The unit is constructed primarily of mild steel. The firebox is lined with vermiculite.

Air Introduction System: Air enters the firebox through an opening located at the front of the appliance above the fuel-loading door. Secondary air enters the appliance through the back and is channeled internally to a single 1-inch square tube.

Combustion Control Mechanisms: The combustion air inlet is controlled by a handle located above the fuel-loading door in the center of the appliance.

Combustor: N/A.

Internal Baffles: A refractory baffle is mounted in the upper portion of the firebox. The flame path is forced to the front of the firebox where it travels up through the opening between the baffle and primary air manifold.

Other Features: None.

Flue Outlet: The 6-inch diameter flue outlet is located in the top of the unit.

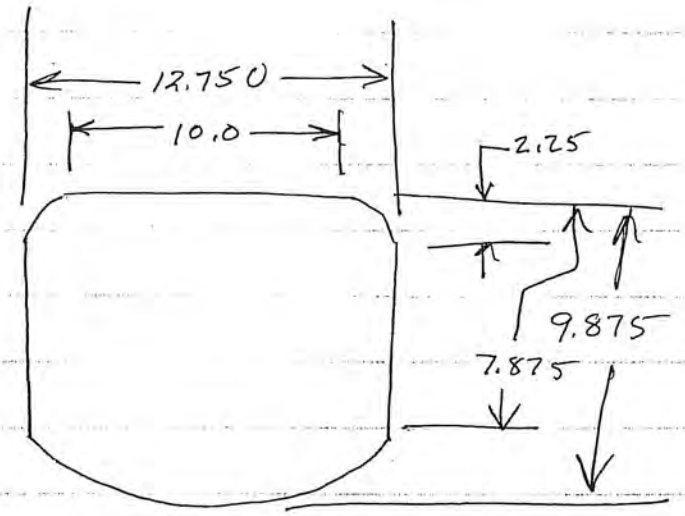
WOOD HEATER OPERATING INSTRUCTIONS

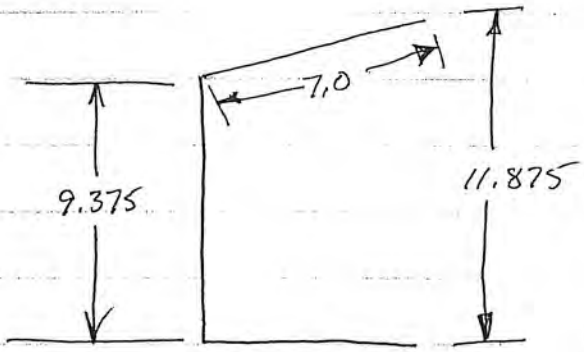
Specific Written Instructions: See Section 3 of this report. All markings and instruction materials were reviewed for content prior to printing.

Engineering Drawings/Blueprints (K List)

10-22-07 MORSO 6100 SERIES 192-5-15-3 #1120

FIREBOX Volume CALCULATION





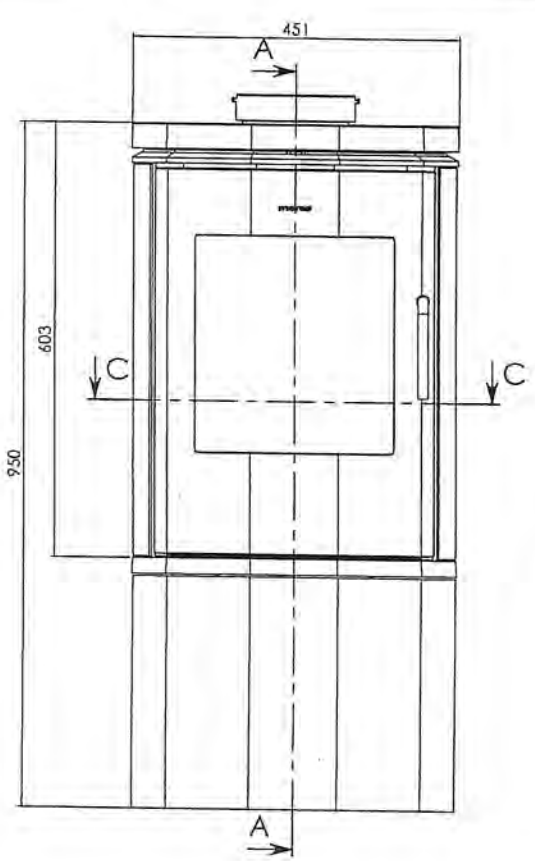
Cad Quarry 1286.2112

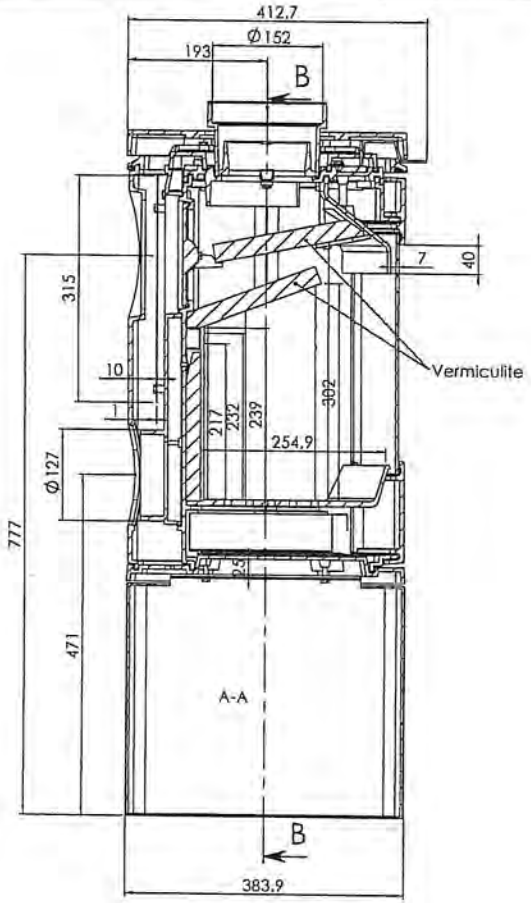
.744 ft^3

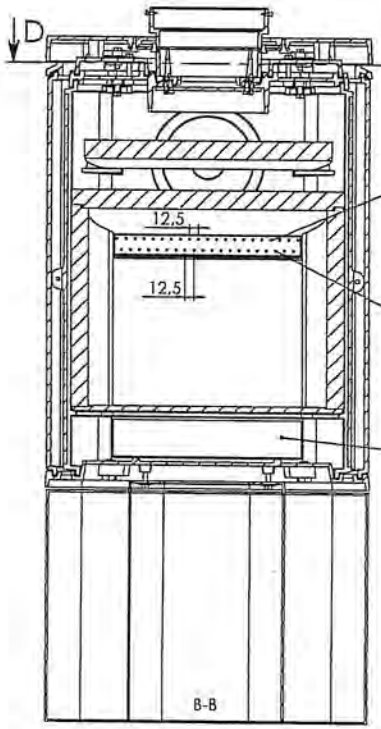
5.208

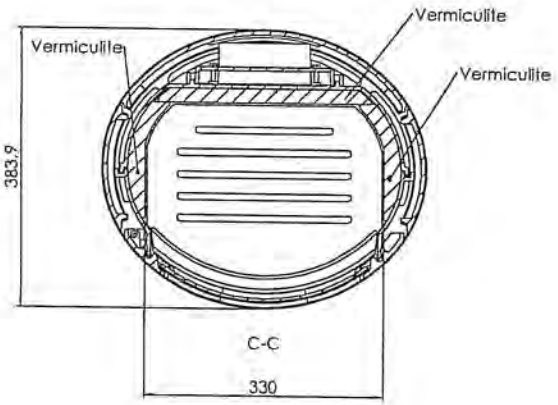
4.7 – 5.7

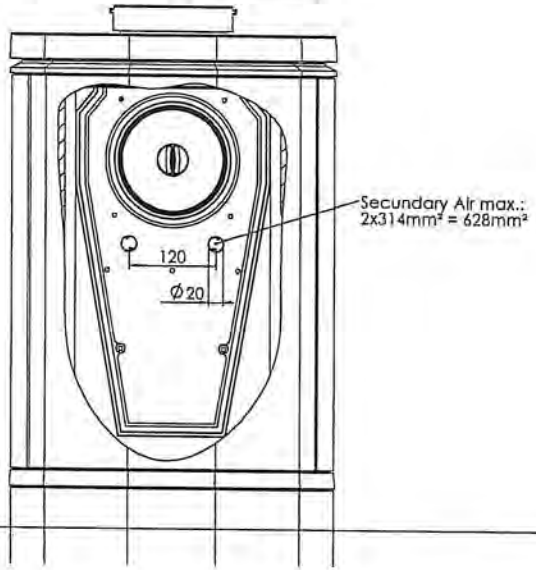
5/6 W = 10.625

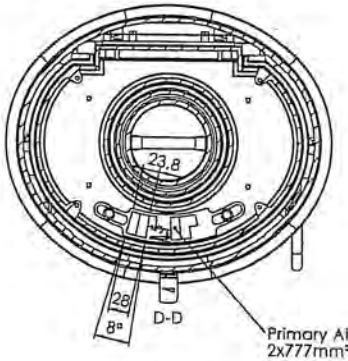


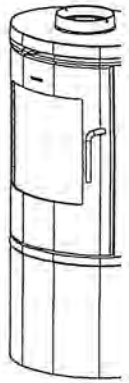












Ck'd Date

Drilling instructions 7.04.02		Rev. Revision:	Sign:
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Weight:	-		Format: A
Model no.			Scale: 1
Drawingtype:	Assembly instructions		Remno.:
Location of file:		morsø	Drawing no.: 6100-86

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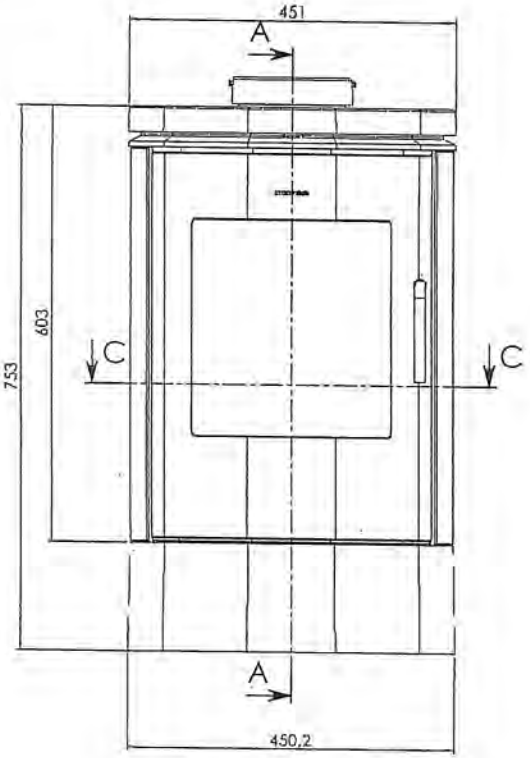
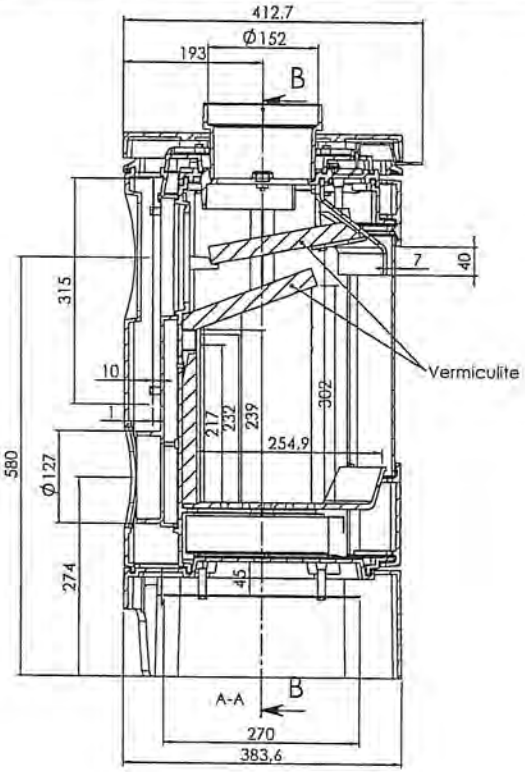
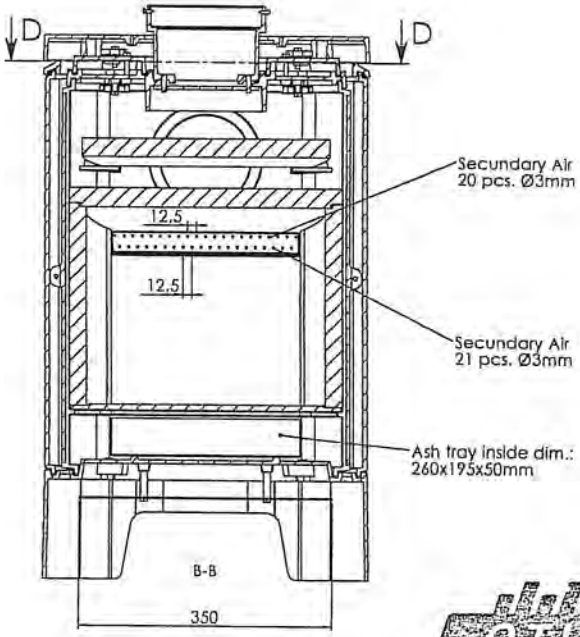
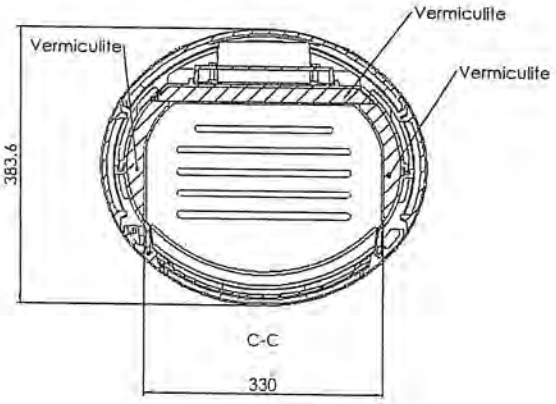
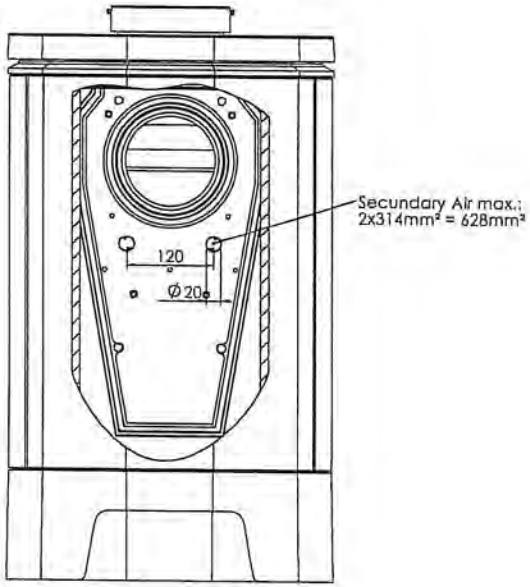


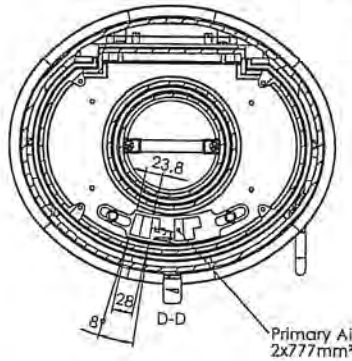


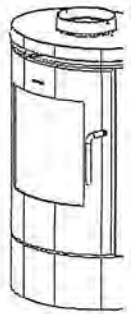


Ck'd PS Date 11/10









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		Semm.:
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Weight: -
Model no.
Drawingtype: Approval Drawing
Location of file:

morsø

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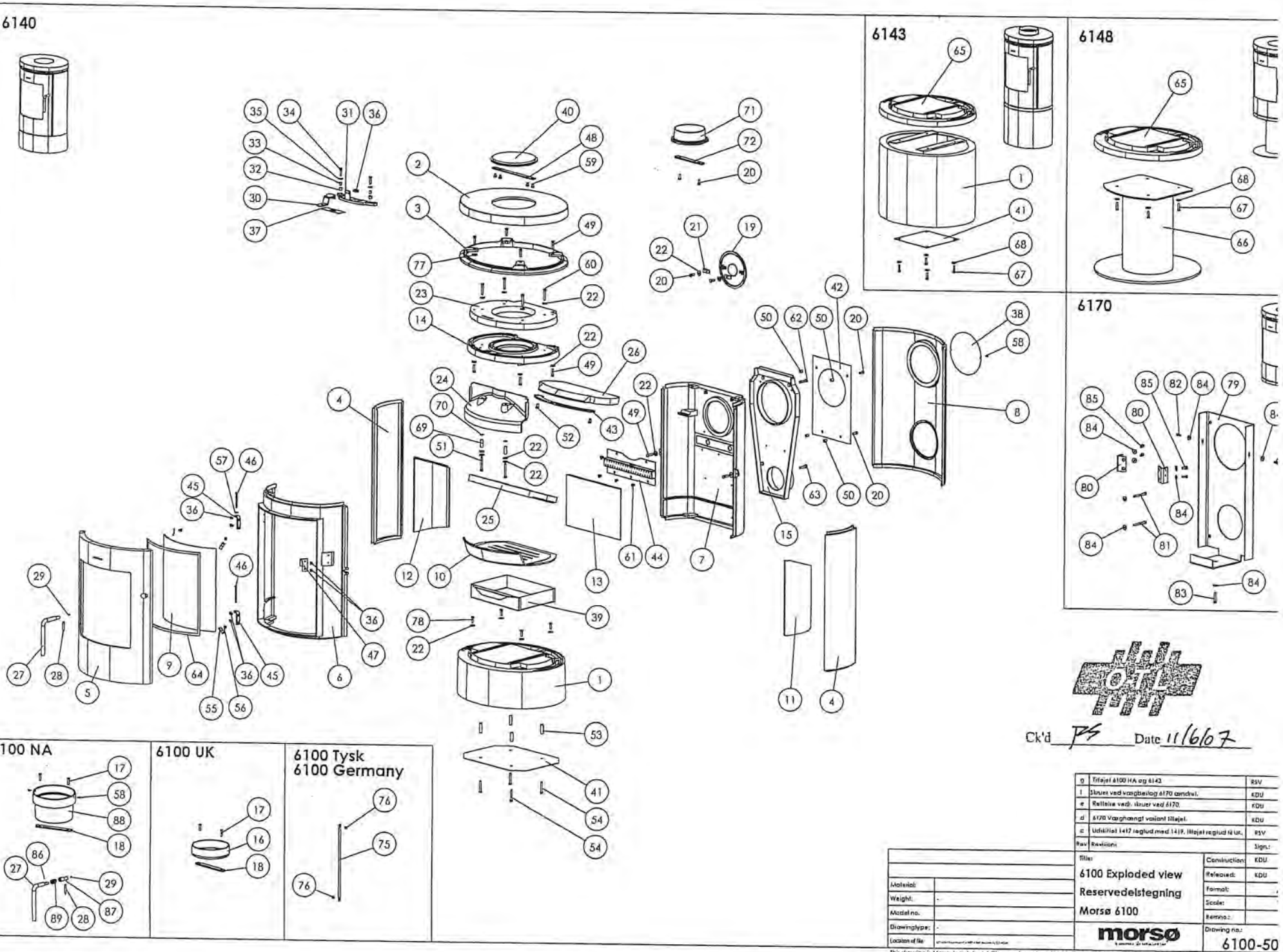
1 - 9 OF 1 - 8 3

Date of print: 26-10-2010



Ck'd PS Date 11/6/07

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1	Skuer ved vaegbeslag 6170 aendret.	KDU
e	Rettelse vedr. skuer ved 6170.	KDU
d	6170 Varghaengt vaiant tilføjet.	KDU
c	Udskiftet 1417 reglud med 1419. Tilføjet reglud til UK.	RSV
Rev	Revision:	Sign.:

Material:	
Weight:	-
Model no.	
Drawingtype:	-
Location of file	

Title:
6100 Exploded view
Reservedelstegning
Morsø 6100

morsø

Construction:	KDU
Released:	KDU
Format:	
Scale:	
Remno.:	
Drawing no.:	6100-50

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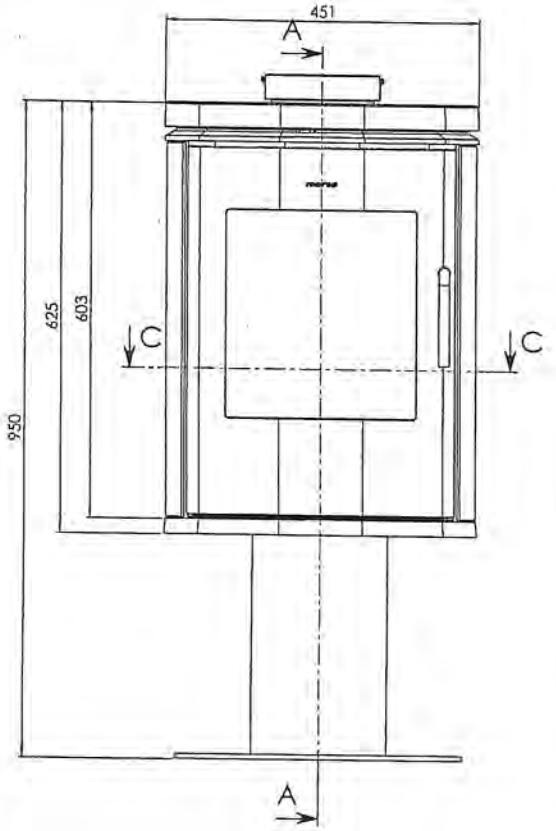
Date of print: 09-11-2007

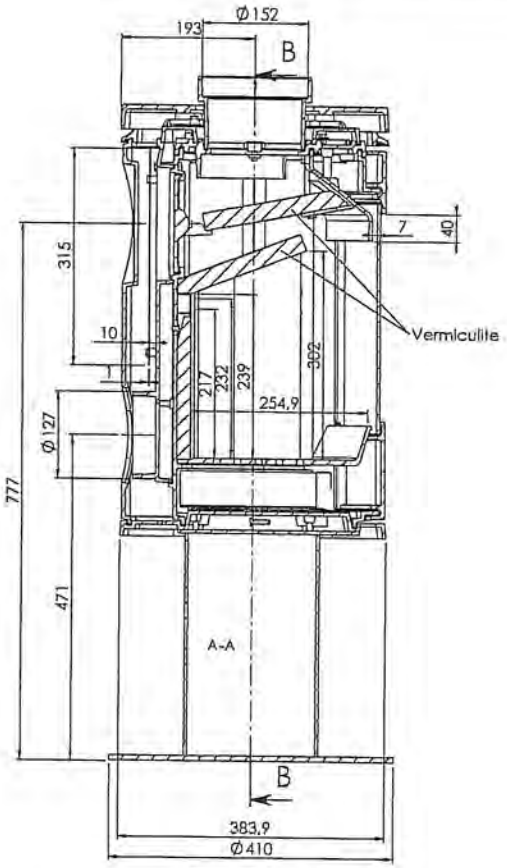
* Revideret: 30.10.07 - RSV

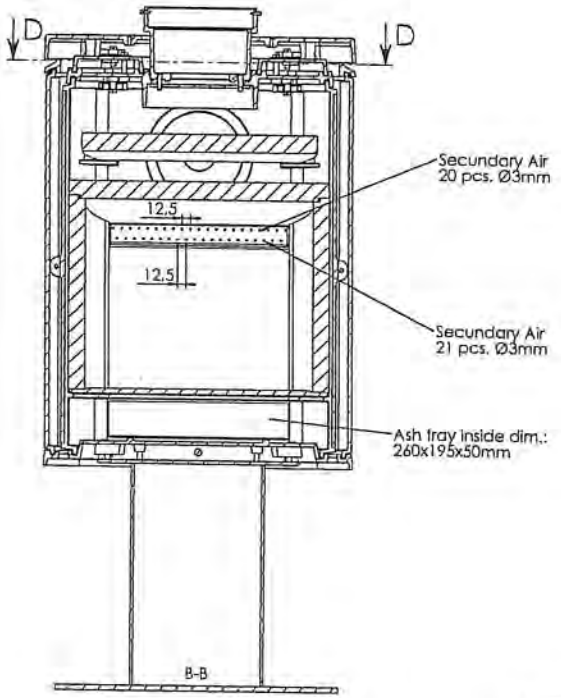
Ck'd PE Date 11/6/07

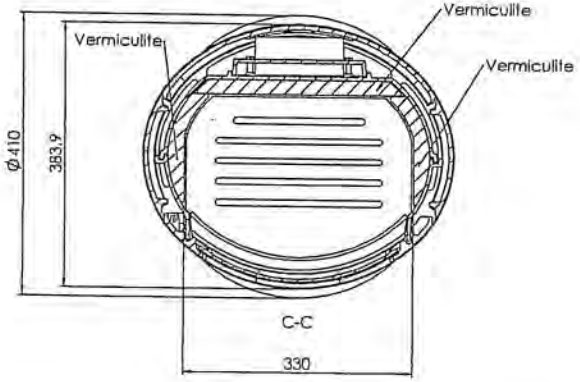
Posnr.	Parts:	6140 NA 646110xx	6143 NA 646111xx	6148 NA 646112xx	6170 NA 646113xx
* 1	Socle	446101xx	716124xx	%	%
2	Top plate, outside	446109xx	446109xx	446109xx	446109xx
3	Top frame	346106xx	346106xx	346106xx	346106xx
4	Side plate, outside	346107xx	346107xx	346107xx	346107xx
5	Door	446103xx	446103xx	446103xx	446103xx
6	Front frame	446102xx	446102xx	446102xx	446102xx
7	Rear plate, inside	446104xx	446104xx	446104xx	446104xx
8	Rear plate, outside	446108xx	446108xx	446108xx	446124xx
9	Glass	79610100	79610100	79610100	79610100
10	Intermediate frame	346110	346110	346110	346110
11	Brick, side, right	79610200	79610200	79610200	79610200
12	Brick, side, left	79610300	79610300	79610300	79610300
13	Brick, back	79610400	79610400	79610400	79610400
14	Top plate, inside	44610500	44610500	44610500	44610500
15	Air canal, rear	44611200	44611200	44611200	44612500
16	Flue collar	%	%	%	%
17	Screw	%	%	%	%
18	Stop bar	%	%	%	%
19	Cover	441410xx	441410xx	441410xx	441410xx
20	Screw	731616	731616	731616	731616
21	Lug	44256800	44256800	44256800	44256800
22	Washer	791891	791891	791891	791891
23	Air canal, top	446113xx	446113xx	446113xx	446113xx
24	Air canal, front	446116xx	446116xx	446116xx	446116xx
25	Baffle plate, lower	79610500	79610500	79610500	79610500
26	Baffle plate, top	79610600	79610600	79610600	79610600
* 27	Handle	75610061	75610061	75610061	75610061
28	Hinge pin	542056	542056	542056	542056
29	Screw	73950500	73950500	73950500	73950500
30	Handle f. sek. draught control	71611261	71611261	71611261	71611261
31	Sek. draught control	71611100	71611100	71611100	71611100
32	Distance tube	71810300	71810300	71810300	71810300
33	Distance tube	71810200	71810200	71810200	71810200
34	Screw	74162000	74162000	74162000	74162000
35	Washer	736106	736106	736106	736106
36	Screw	73851100	73851100	73851100	73851100
37	Closing plate for sek. draught control	71610800	71610800	71610800	71610800
38	Roundel	716110xx	716110xx	716110xx	716110xx
39	Ash can	71610100	71610100	71610100	71610100
40	Cover	448120xx	448120xx	448120xx	448120xx
* 41	Radiant shielding, bottom	71610300	71612500	%	%
42	Radiant shielding, rear	71610200	71610200	71610200	71612200
43	Fitting plate for baffle	71610461	71610461	71610461	71610461
44	Tertiary box	71610561	71610561	71610561	71610561
45	Hinge fitting	718101xx	718101xx	718101xx	718101xx
46	Screw	74701000	74701000	74701000	74701000
47	Closing fitting	71610700	71610700	71610700	71610700
48	Lug for cover	71813200	71813200	71813200	71813200
49	Screw	731625	731625	731625	731625
50	Distance tube	541439	541439	541439	541439
51	Screw	731650	731650	731650	731650
52	Screw	731612	731612	731612	731612
53	Distance tube	542641	542641	%	%
54	Screw	731640	731640	%	%
55	Glass fitting	71814561	71814561	71814561	71814561
56	Screw	742508	742508	742508	742508
57	Washer	746006	746006	746006	746006
58	Screw	791835	791835	791835	791835
59	Screw	731608	731608	731608	731608
60	Screw	731640	731640	731640	731640
61	Screw	74361000	74361000	74361000	74361000
62	Screw	731635	731635	731635	731635
63	Screw	731630	731630	731630	731630
64	Tape for glass	79074200	79074200	79074200	79074200
65	Bottom plate	%	446115xx	446115xx	446126xx
66	Pedestal	%	%	546115xx	%
67	Screw	%	%	731625	%
68	Washer	%	%	791891	%
69	Distance tube	541440	541440	541440	541440
70	Washer	746206	746206	746206	746206
71	Flue collar	441419xx	441419xx	441419xx	441419xx
72	Stop bar	71611800	71611800	71611800	71611800
75	Spring	%	%	%	%
76	Screw	%	%	%	%
77	Washer	736210	736210	736210	736210
78	Screw	731620	731620	731620	731620
79	Fitting for wall	%	%	%	716120xx
80	Fitting for fitting for wall	%	%	%	716121xx
81	Screw	%	%	%	73166000
* 82	Screw	%	%	%	73861400
83	Screw	%	%	%	731635
84	Washer	%	%	%	791891
85	Screw	%	%	%	731612
* 86	Cotter pin	74201900	74201900	74201900	74201900
* 87	Axle f. door	75610161	75610161	75610161	75610161
* 88	Flue collar	446118xx	446118xx	446118xx	446118xx
* 89	Spring	79048800	79048800	79048800	79048800

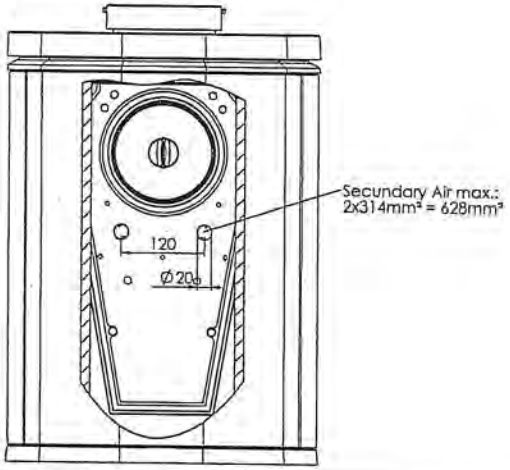
Vermiculite complete 6100	79610700	79610700	79610700	79610700
Handle complete	54610000	54610000	54610000	54610000

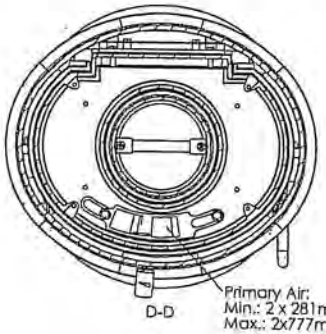


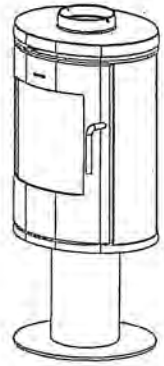












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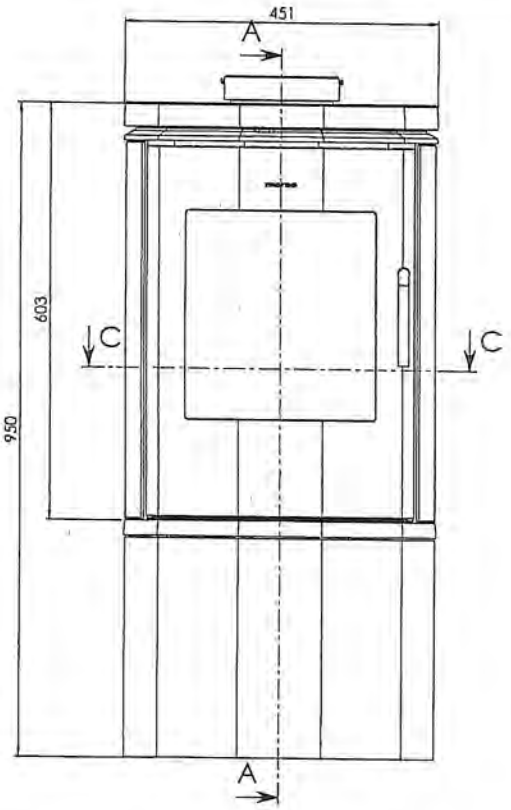
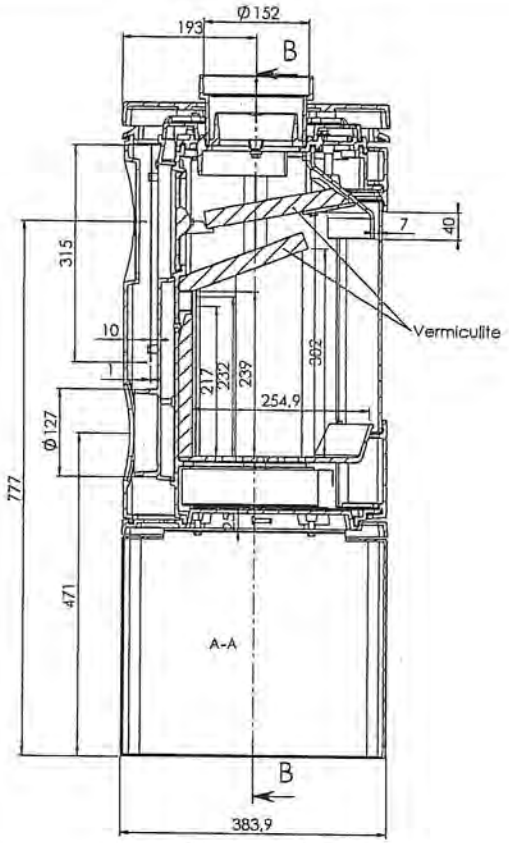
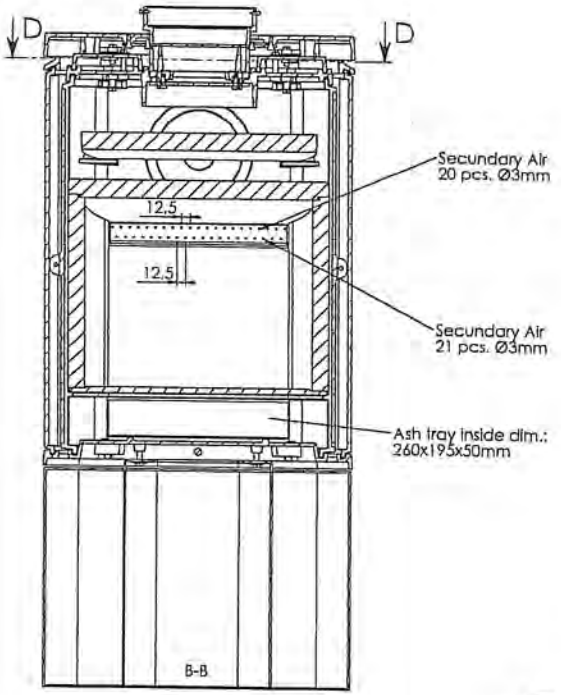
		Scale:	1:5
		Remna.:	
Dim. without indication of range acc. to DS/ISO 2768-1 m		morsø	Drawing no.: 6100-82 b
Material:			
Weight:	-		
Model no.:			
Drawingtype:	Approval Drawing		
Location of file:			

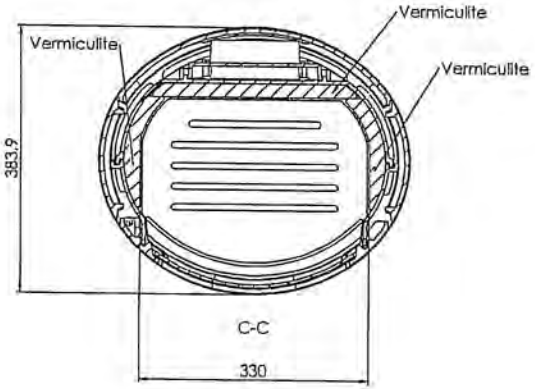
This drawing is Morsø Jernstøberi A/S' property and must not be sold, lended or copied without any written authorization from the company.

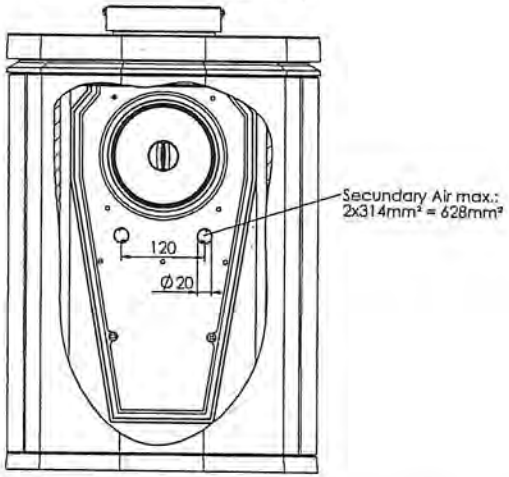
Date of print: (9-11-2007)

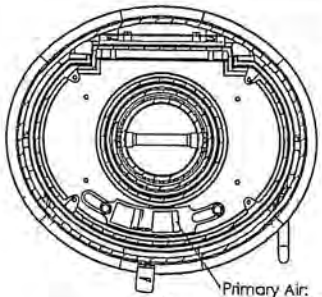


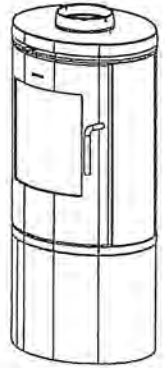






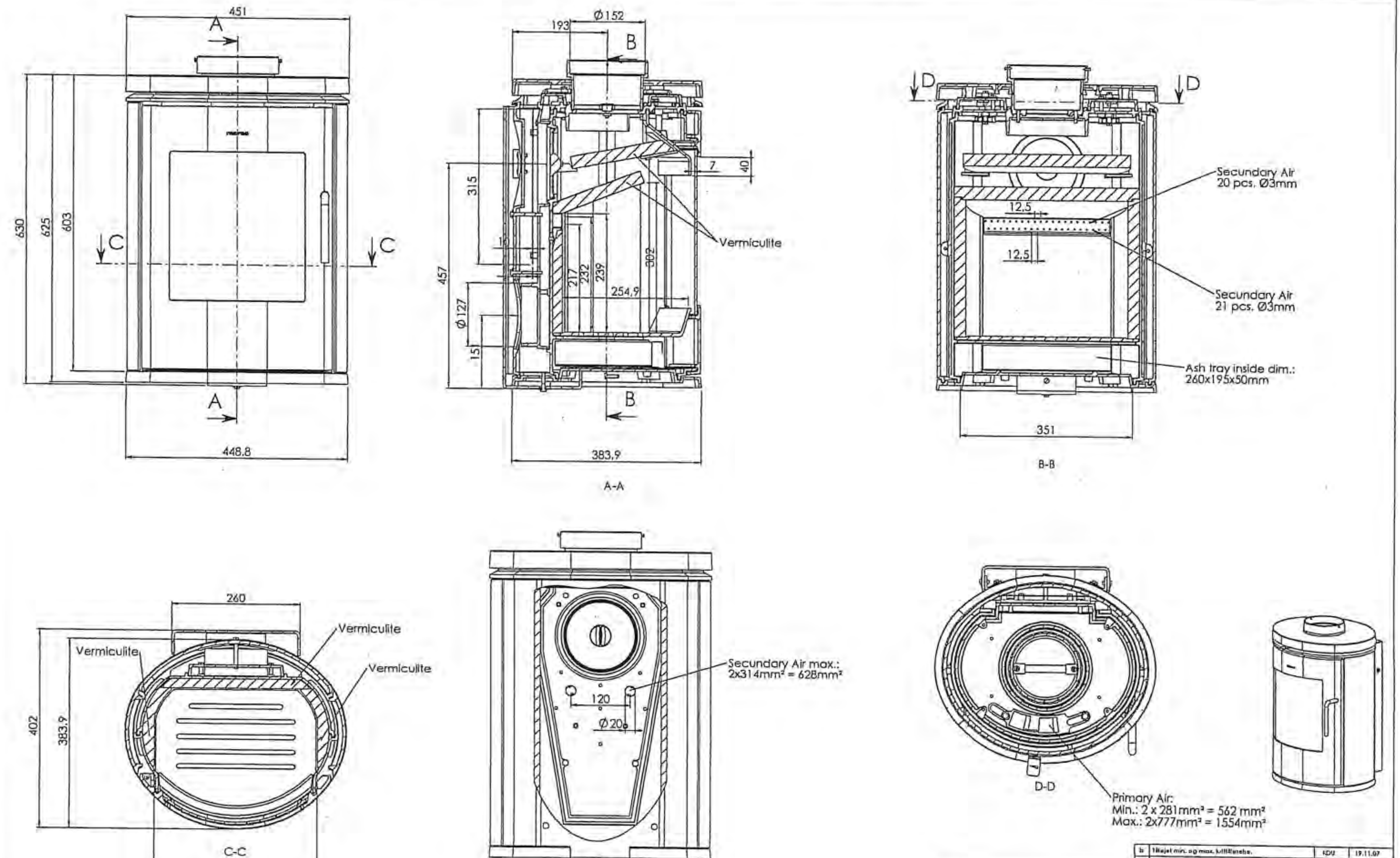






b	Min. og Max. luftflorelse tilføjet.		KDU	19.11.07
Rev	Revisions		Sign:	Date:
Drilling instructions 7.04.02	Title:	Construction:	RSV	29.10.2007
Dim. without indication of margin acc. to ISO Norm No.: 8062 CT9	Approval Drawing Morsø 6143 NA	Released:		
Material:		Format:	A2	
Weight: ~		Scale:	1:5	
Model no.		Item no.:		
Drawing type: Assembly instructions	morsø	Drawing no.:	6100-86 b	
Location of file:				

This drawing is Morso Jernstøberi A/S' property and must not be sold, landed or copied without any written authorisation from the company.

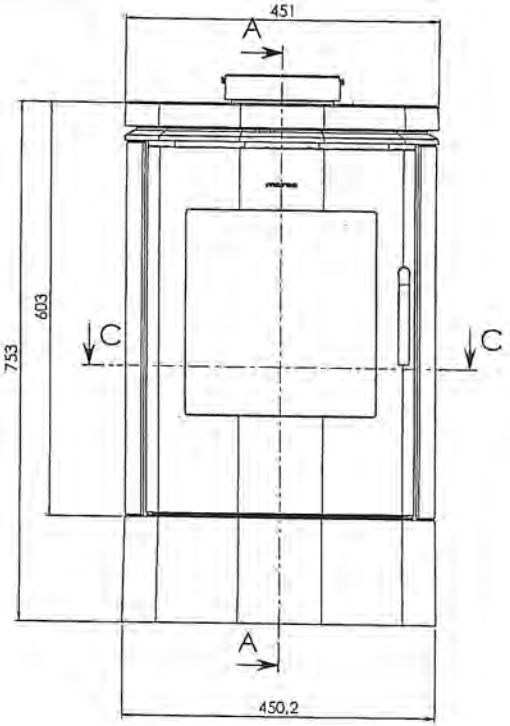


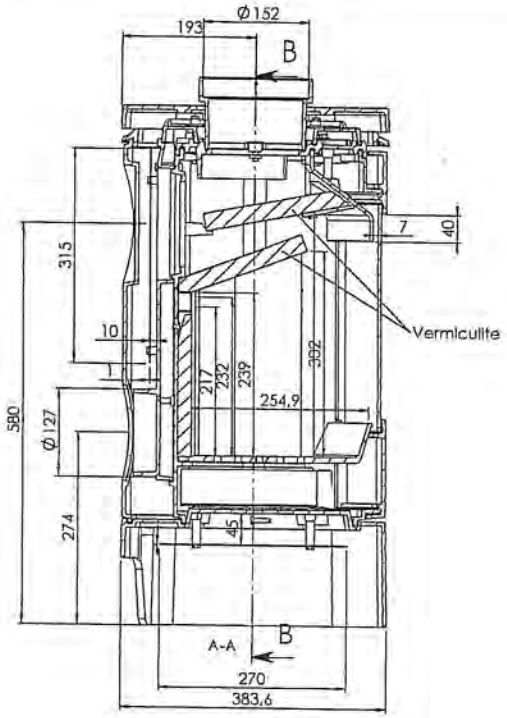
b	Tilføjet min. og max. luftåbninger.	FDU	19.11.07
Rev.	Revisions	Sign.:	Date:
Title:		Construction: RSV	29.10.2007
Approval Drawing		Released:	
Morsø 6170 NA		Format:	A2
		Scale:	1:5
		Itemno.:	
morsø		Drawing no.:	6100-83 b

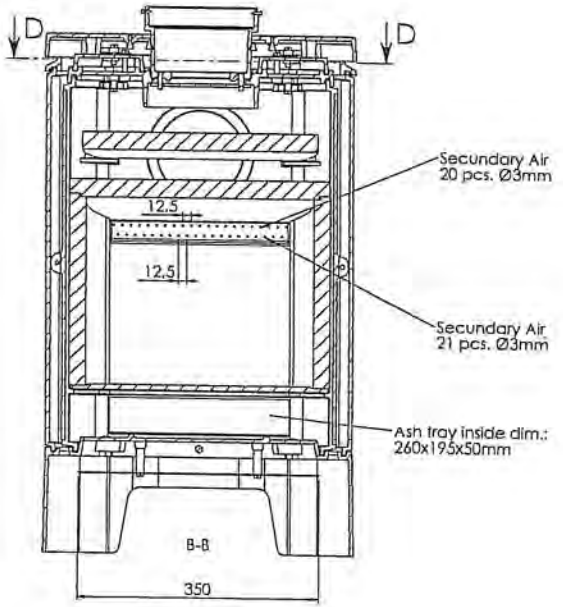
Material:
Weight: -
Model no.:
Drawingtype: Approval Drawing
Location of file:

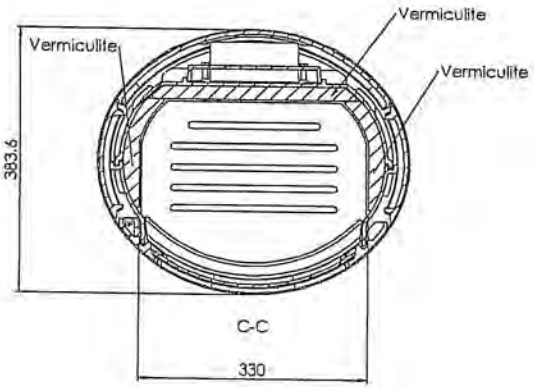
This drawing is Morsø Jernstøberi A/S' property and must not be sold, lended or copied without any written authorization from the company.

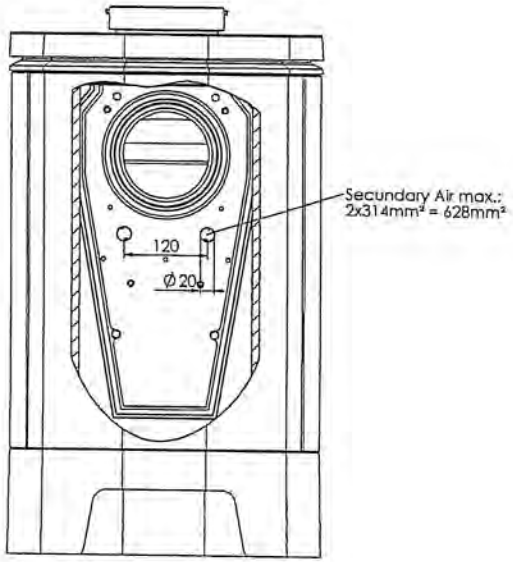
Date of print: 19-11-2007

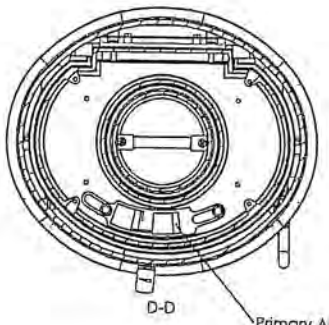


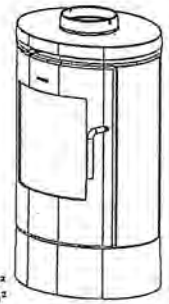












		b	Min. og max. luftåbninger tilføjet.	KDU	19.11.07
		Rev.	Revision	Sign:	Date:
		Title:	Approval Drawing Marsø 6140 NA	Construction:	RSV 26.10.2007
				Released:	
				Format:	A2
				Scale:	1:5
				Item no.:	
Dim. without indication of margin acc. to DS/ISO 3768-1 m				Drawing no.:	6100-81 b
Material:					
Weight:	-				
Model no.					
Drawingtype:	Approval Drawing				
Location of file:					

morsø

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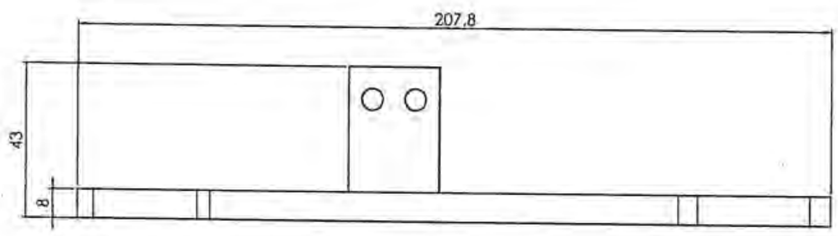
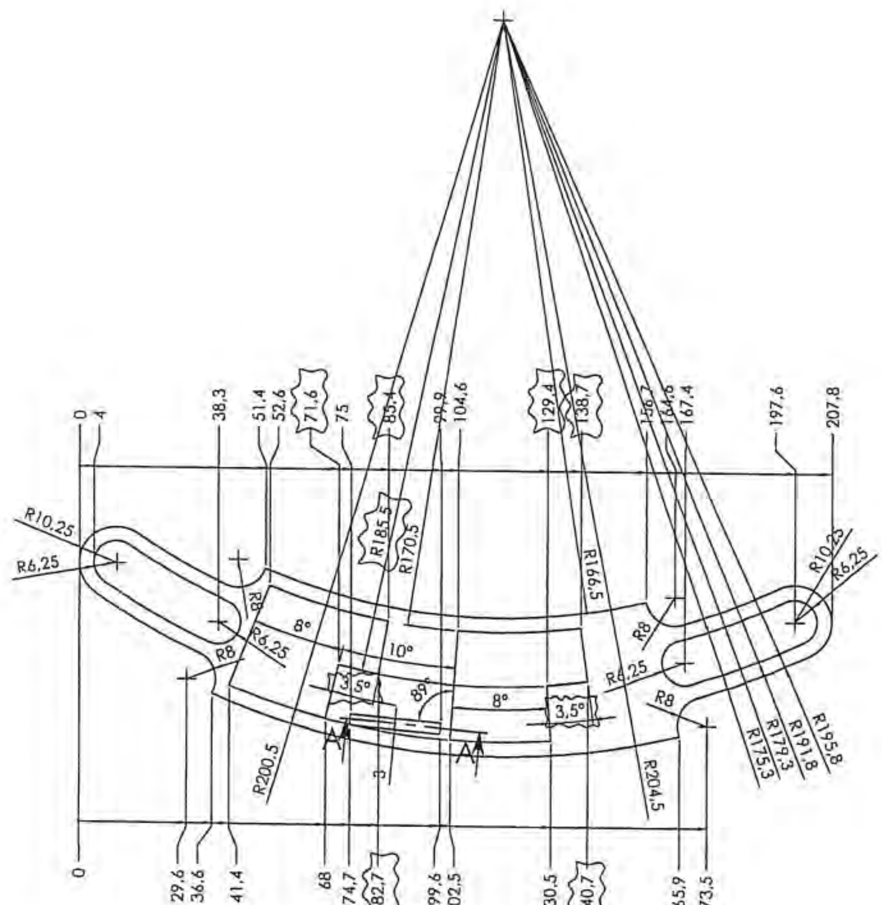
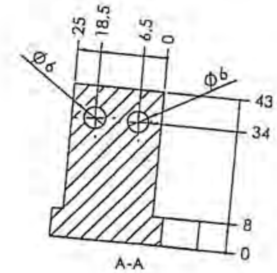
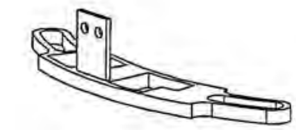
Date of print: 19-11-2007









OTL

Ck'd ZS Date 11/6/07

GRATER FJERNES !!!

	Rev Revision			Sign.:
	Title:		Construction:	KDU
Mål uden toleranceangivelse f.h.t. DS/ISO 2768-1 m	Sekundær spjæld 6100		Released:	KDU
Material: SPD Plade	Primary daught cont. NA		Format:	A
Weight: 0,24 kg			Scale:	1
Model no.: -	Morsø 6100		Itemno.:	7161
Drawingtype: Emnetegning	morsø		Drawing no.:	6100-37
Location of file:				

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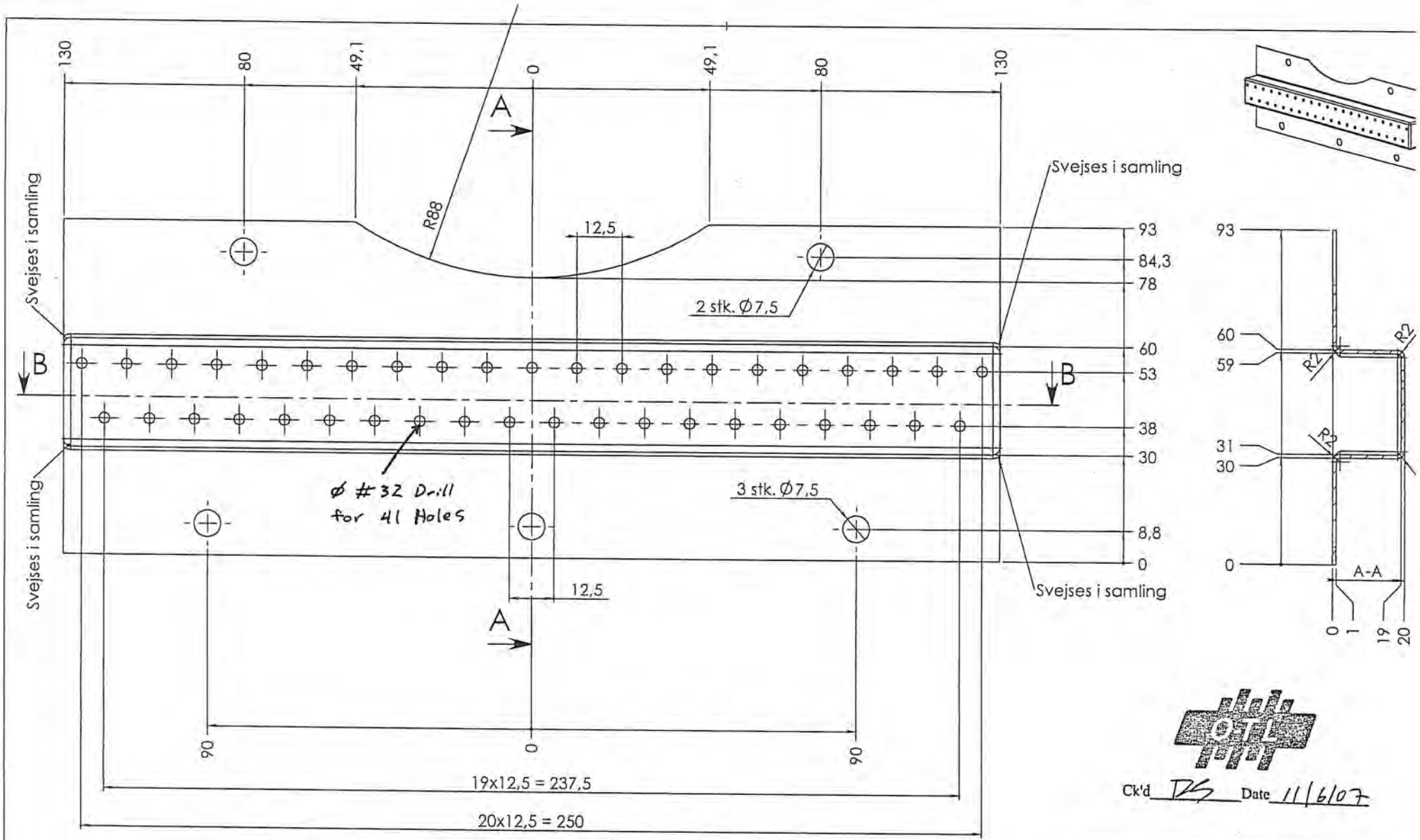
Date of print: 29-10-2007



Ck'd DS Date 11/6/07

Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	
Material:	Rustfri stål
Weight:	0,26 kg
Model no.	-
Drawingtype:	Emnetegning
Location of file:	

Rev.	Revisions	Sign.:	Dat
Title:		Construction:	KDU 05.10
Tertiær boks 6100		Released:	KDU 30.05
Secundary box NA		Format:	A3
Morsø 6100		Scale:	1:1
		Itemno.:	7161056
morsø		Drawing no.:	6100-30 a

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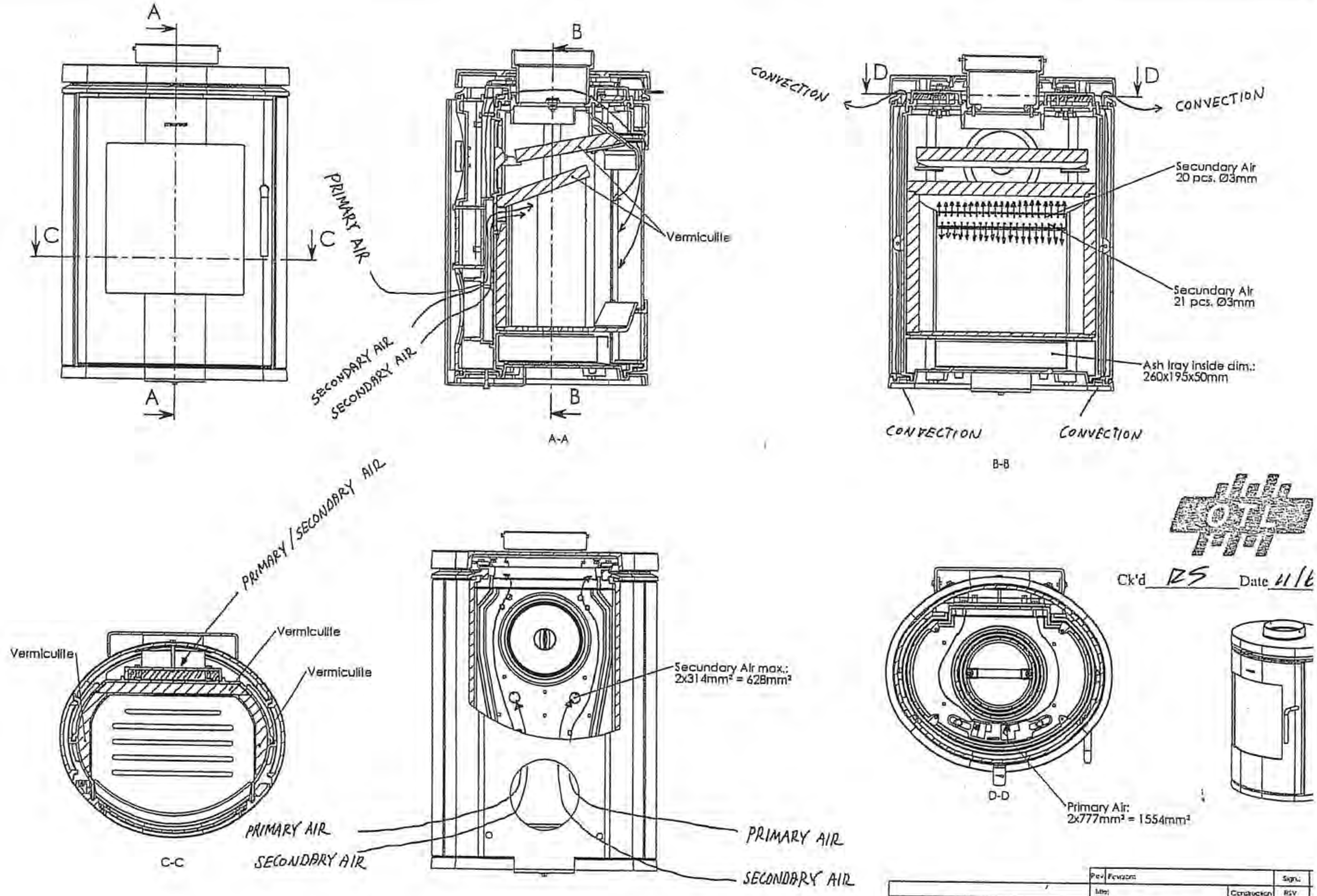
Date of print: 29-10-2007



Dim. without indication of margin acc. to DS/ISO 2768-1m

Airflowdiagram

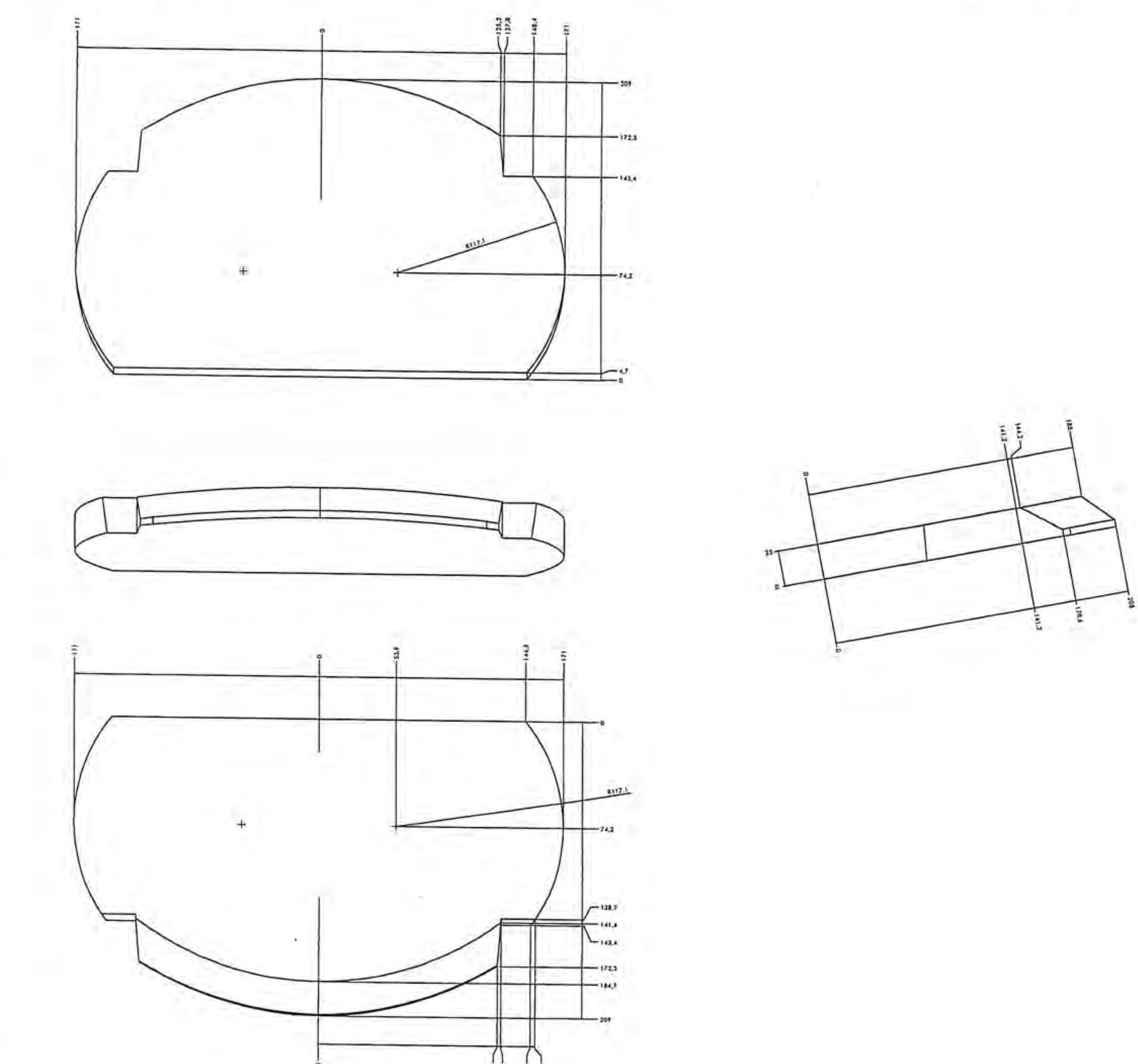
Morsø 6100 serie NA

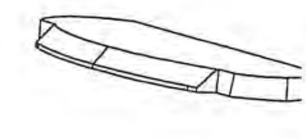
Drawingtype: Airflowdiagram

Construction: RSV

morsø

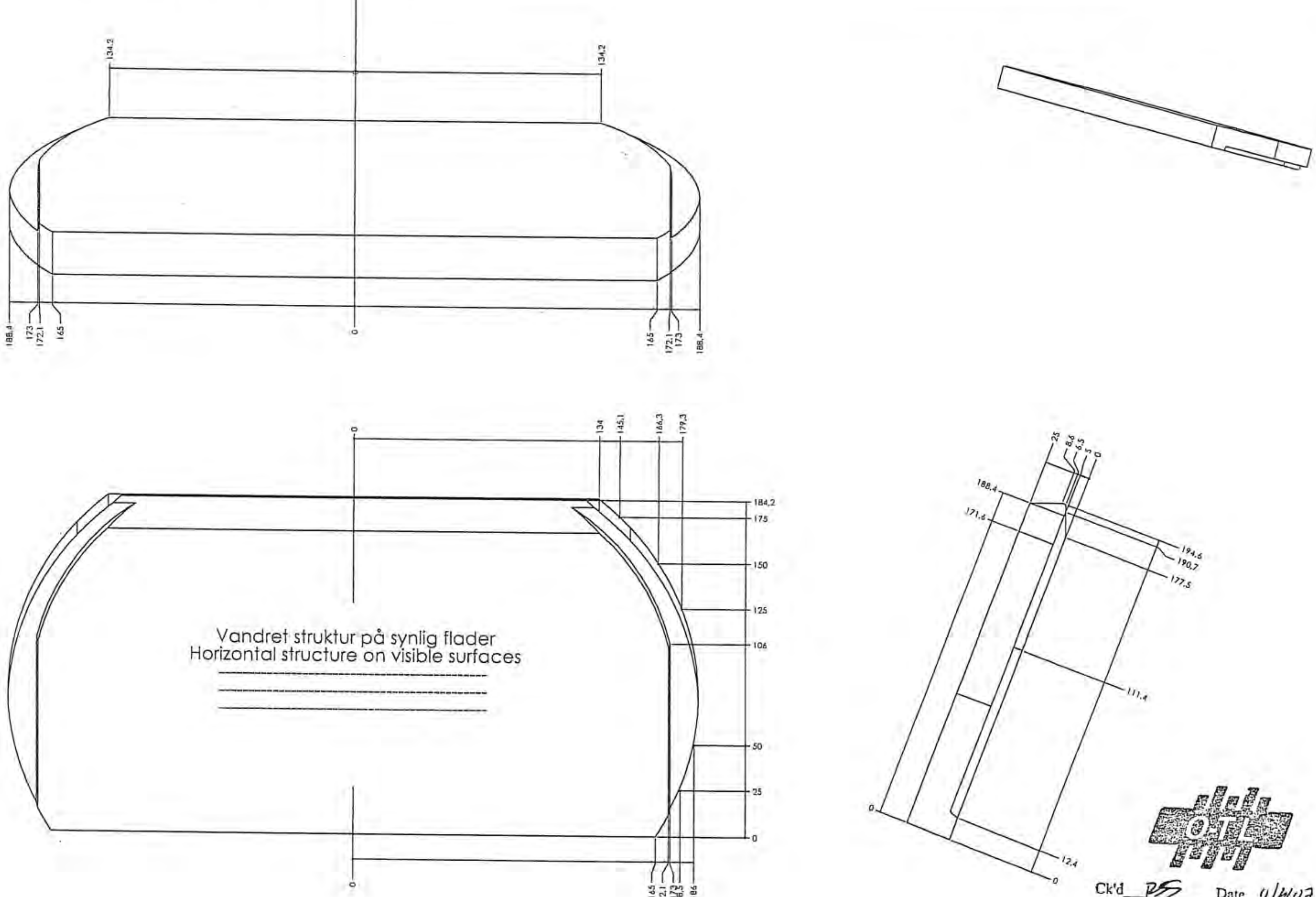
Drawing no.: 6100-85





Ck'd [signature] Date 11/6/07

Regvendepl. øvent 610
Baffle plate, top
Morsø 6100
morsø



Ck'd [signature] Date 11/6/07

Røgvendepl. nederst 6100
Baffle plate, bottom
Morsø 6100

morsø

6100

V-1100 (600) Vermiculite insulating slabs

for hot-face and back-up insulation - up to 1100°C (2012°F)

Maximum service temperature		
	°C	1100
	°F	2012
Bulk density, dry		
	kg/m³	600
	lbs/cu.ft.	37.5
Compressive strength (EN 1094-5: 1995)		
@ room temperature	MPa	4.2
	lbs/sq.in.	609
Modulus of rupture (EN 993-6: 1995)		
	MPa	1.6
	lbs/sq.in.	232
Total porosity (EN 1094-4: 1995)		
	%	76
Specific heat		
	kJ/(kg×K)	0.94
	BTU/(lb×°F)	0.224
Coefficent of reversible thermal expansion (BS 1902: section 5.3: 1990)		
@ 20°C-750°C (68°F-1382°F)	K^{-1}	11×10^{-6}
	$°F^{-1}$	6.1×10^{-6}
Resistance to thermal shock (EN 993-11: 1998)		
heating to 950°C (1742°F)	cycles	>10
Linear reheat shrinkage (EN 1094-6: 1999)		
@ 1000°C	%	1.0
@ 1100°C	%	
Pyrometric cone equivalent (ASTM C24-89 ORTON cones)		
	°C	1300
	°F	2372
Thermal conductivity (ASTM C-182)		
mean temp. @ 200°C	W/(m×K)	0.15
mean temp. @ 400°C	W/(m×K)	0.16
mean temp. @ 600°C	W/(m×K)	0.19
mean temp. @ 800°C	W/(m×K)	-
mean temp. @ 392°F	BTU/(sq.ft.×h×°F/in.)	1.04
mean temp. @ 752°F	BTU/(sq.ft.×h×°F/in.)	1.11
mean temp. @ 1112°F	BTU/(sq.ft.×h×°F/in.)	1.32
mean temp. @ 1472°F	BTU/(sq.ft.×h×°F/in.)	-
Chemical analysis, typical	%	
Silica	SiO_2	47
Titanium dioxide	TiO_2	0.5
Ferric oxide	Fe_2O_3	4
Alumina	Al_2O_3	7
Magnesium oxide	MgO	21
Calcium oxide	CaO	2
Sodium oxide	Na_2O	0.5
Potassium oxide	K_2O	11
Loss on ignition 1025°C (1877°F)	LOI	7
Colour		sand

Data are average results of tests conducted under standard procedures and are subject to variation. Data contained in this data sheet are supplied in good faith as a technical service and are subject to change without notice. Misprint and errors excepted.

Ck'd PSS Date 4/6/07

Skamol A/S is DS/EN ISO 9001 certified.

March 2004

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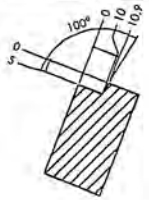
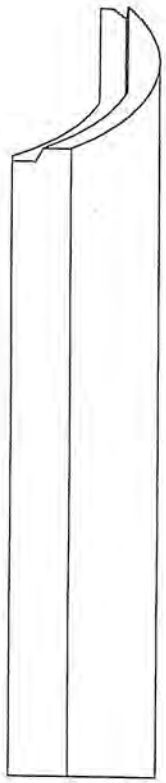
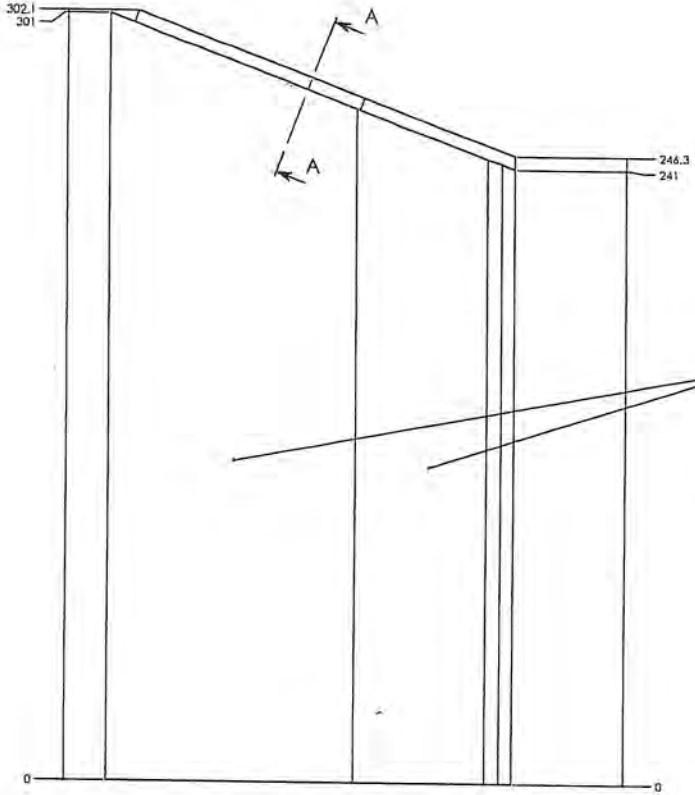
8318 Pineville-Matthews R
Suite 267
Charlotte, NC 28226
USA
Tel: +1 (704) 544-1015
Fax: +1 (704) 544-1239

www.skamol.com

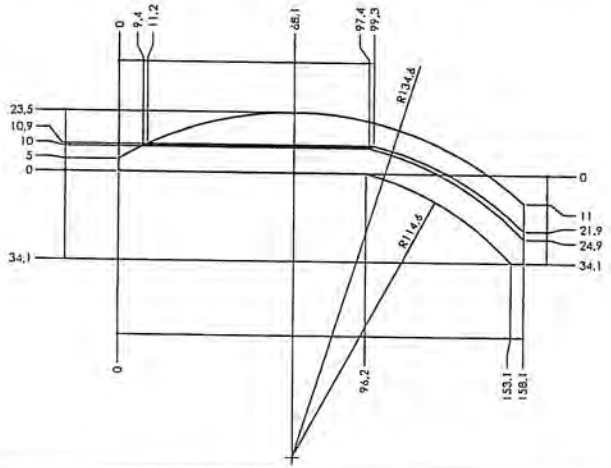


A–A





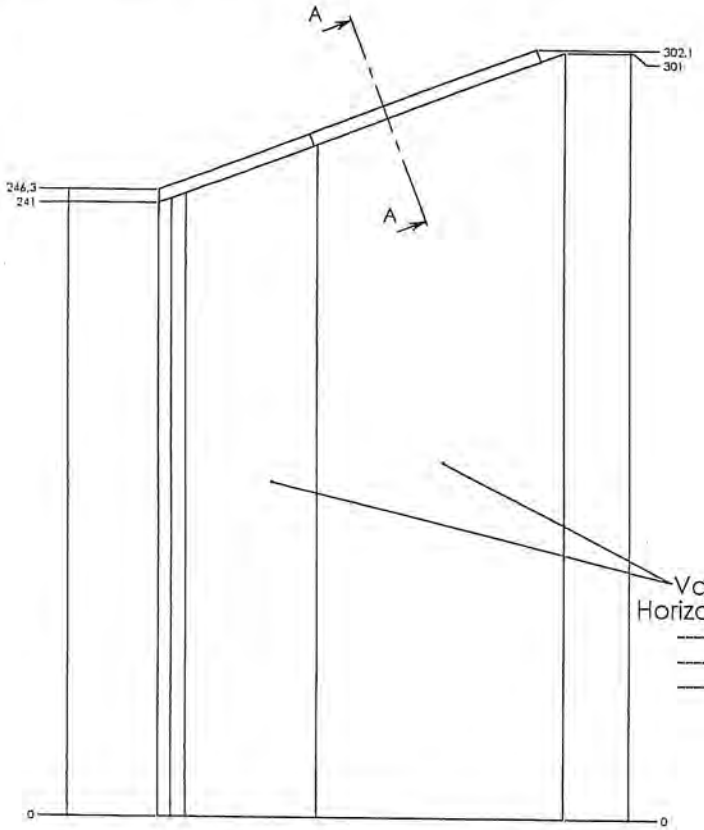
Vandret struktur på synlig flader
Horizontal structure on visible surfaces

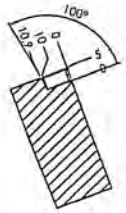


Ck'd TS Date 11/6/07

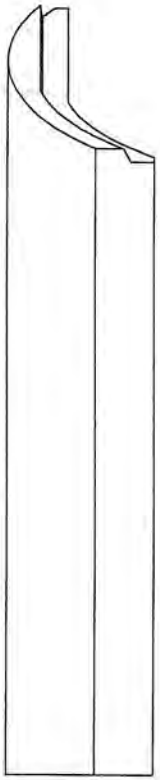
		Title: Sidesten venstre 6100 Brick, side, left Morsø 6100	
		morsø	6100

1 - 22 OF 1 - 83

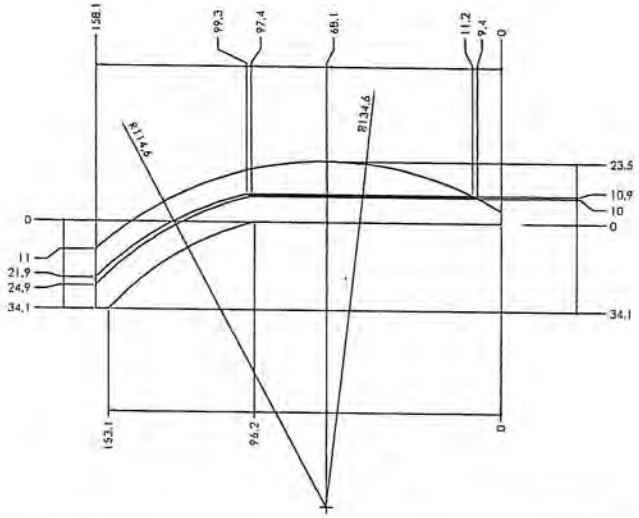




A-A



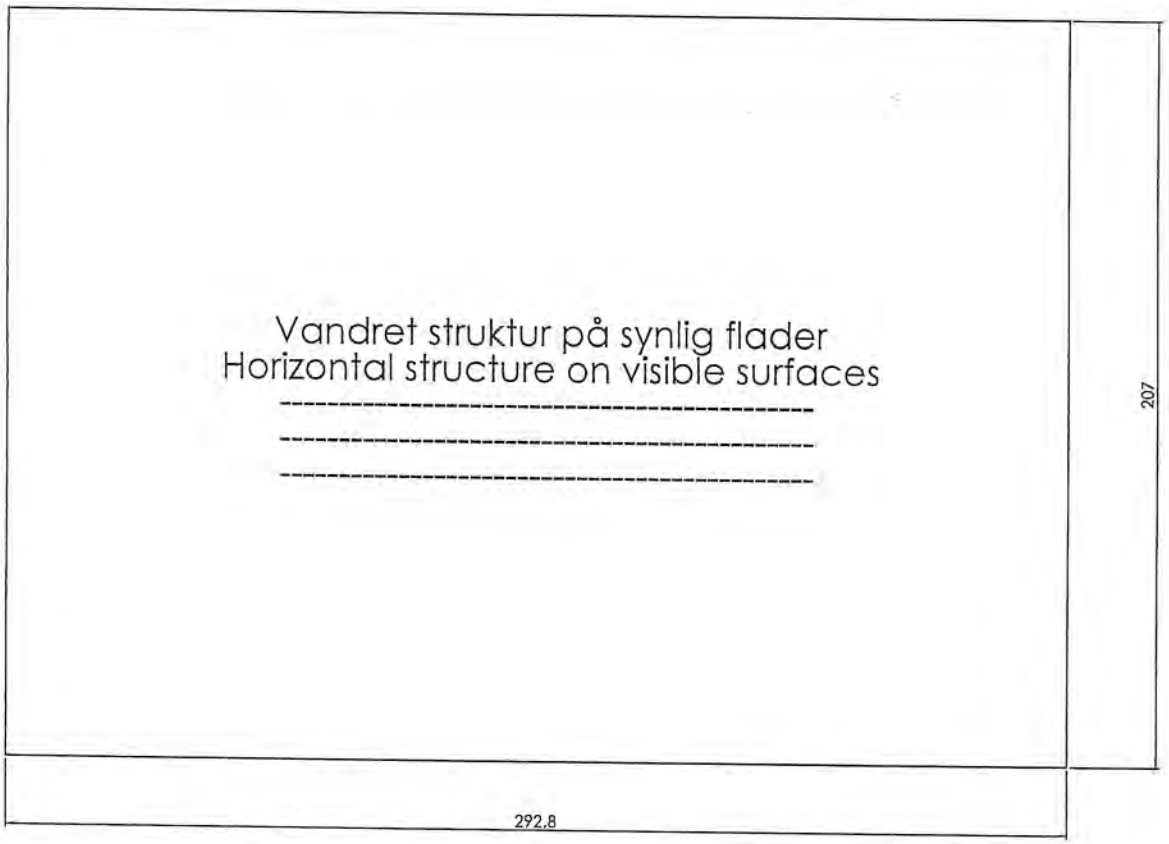
Vandret struktur på synlig flader
Horizontal structure on visible surfaces

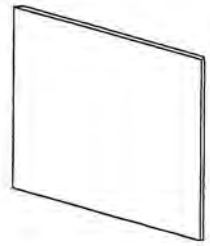


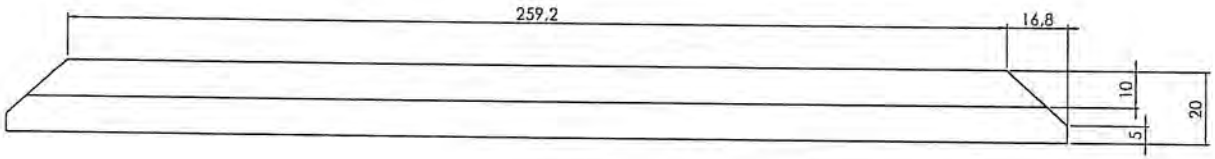
Ck'd TDS Date 11/6/07

	Sidesten højre 6100	
	Brick, side, right	
	Morsø 6100	
	morsø	6100

1 - 23 OF 1 - 83







Ck'd TRG Date 11/6/07

		Rev	Revision		Sign:
		Title:		Construction:	KDU
General tolerance: +1mm, -2mm		Bagsten 6100		Released:	KDU
Material:	Vermiculite v-1100 ME-2	Brick, back		Format:	A
Weight:	0.66 kg	Morsø 6100		Scale:	1
Model no.	-			Itemno.:	7961
Drawingtype:	Product Drawing	morsø		Drawing no.:	6100-23
Location of file:					

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Date of print: 29-10-2007

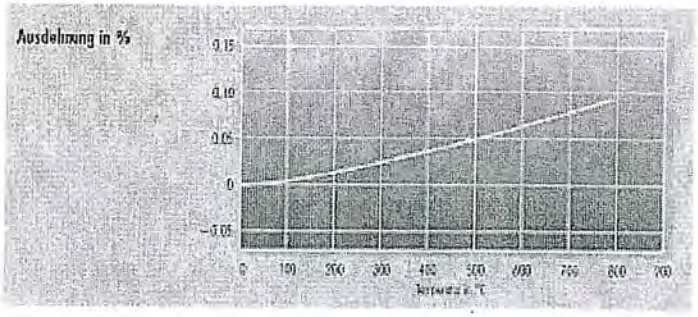
Glaskeramik NEOCERAM N-0
Technische Daten
Wärmeausdehnung
Lichtdurchlässigkeit

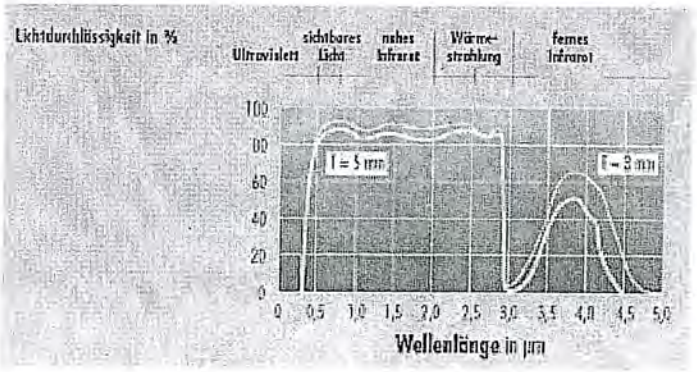
Oberflächenbeschaffenheit
Flache Scheiben/Beschichtete Glaskeramik/Einbaurichtlinien

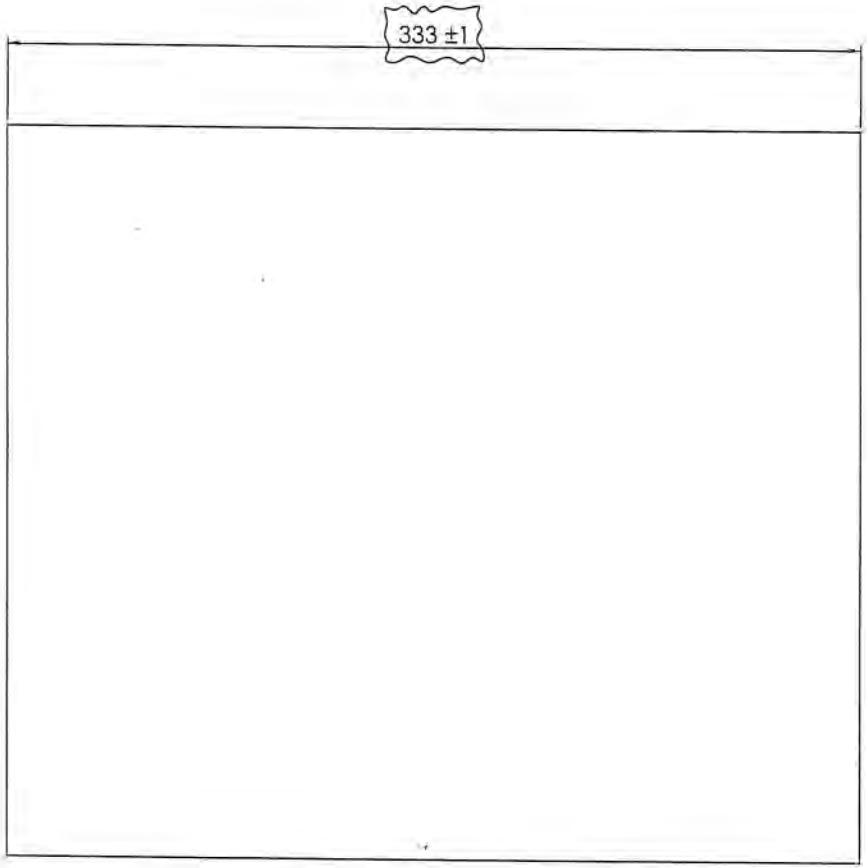
Ck'd PGS Date 11/6/07

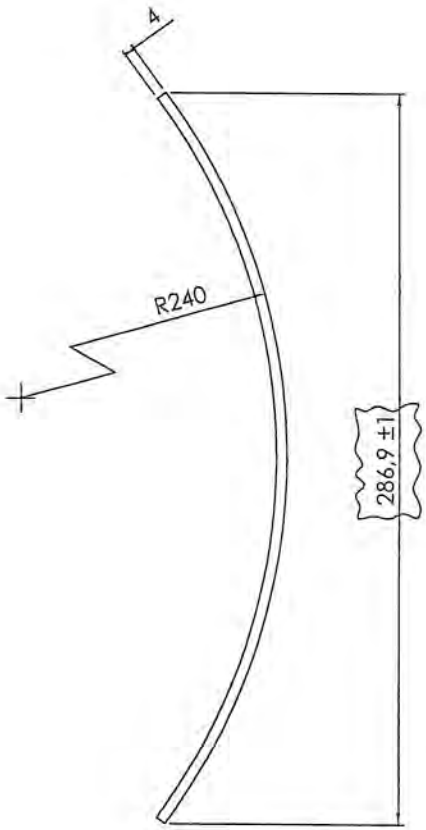
Technische Daten

Ausdehnungs-koeffizient	· 10-7/K	(30 - 380° C) – 6 (30 - 750° C) – 3
Temperatur-wechselbeständigkeit	°C	800
Maximale Betriebstemperatur	°C	kontinuierlich 700 kurzzeitig 800
Wärmeleitfähigkeit	W/m · K (25° C)	1,51
Spezifische Wärme	J/kg · K	712
Dichte	g/cm3	2,51
Biege- und Schlagfestigkeit	entsprechen den Eigenschaften von Gussglas	









Ck'd RS Date 11/6/07

Rev.	Revisions	Sign.:	Dat
c	Modified tolerance after request from supplier.	KDU	01.03
b	Approval of the glass.	KDU	30.05

Indication of margin see Drawing		Title: Glass 6100	Construction: KDU 22.09
Material:	Keramisk glas		Released: KDU 30.05
Weight:	1,02 kg		Format: A3
Model no.	-	Morsø 6100	Scale: 1:2
Drawingtype:			Itemno.: 7961010
Location of file:		morsø	Drawing no.: 6100-20 c

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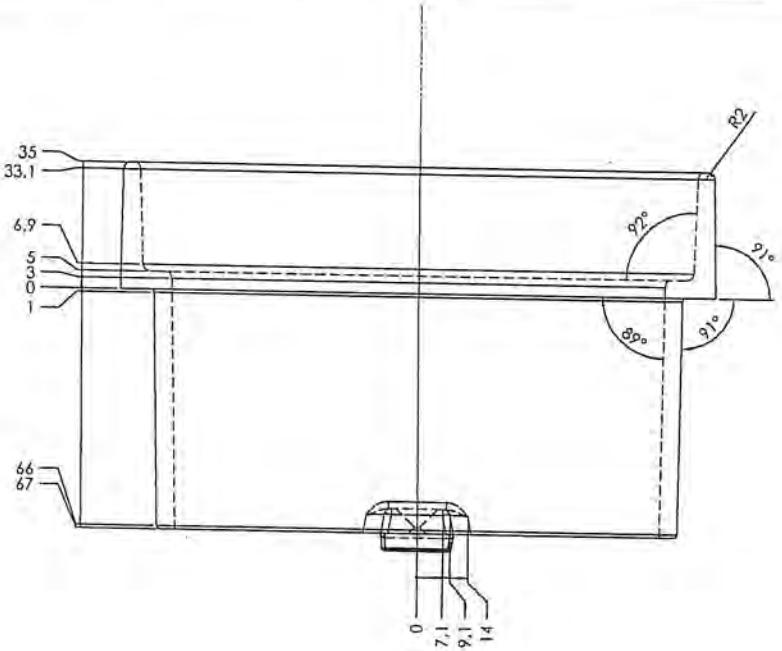
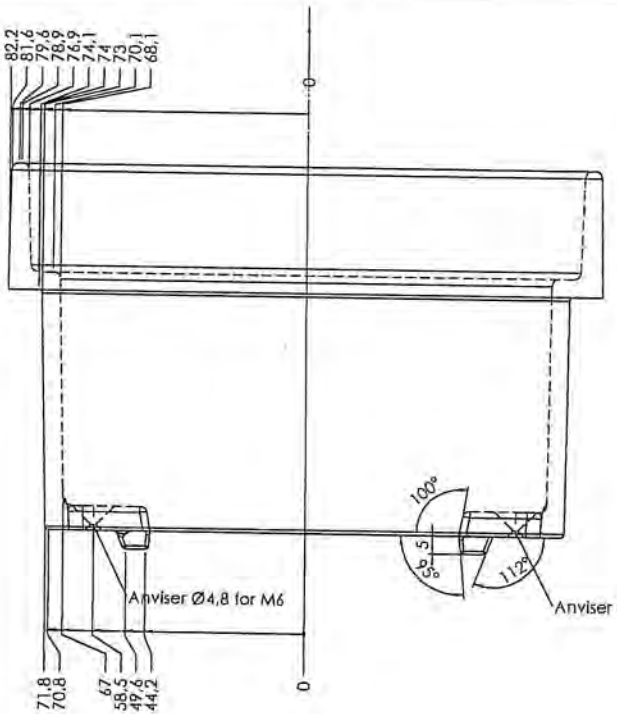
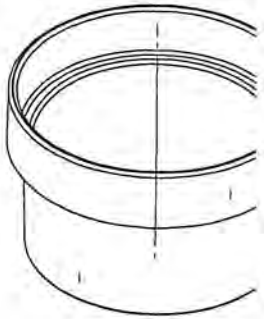
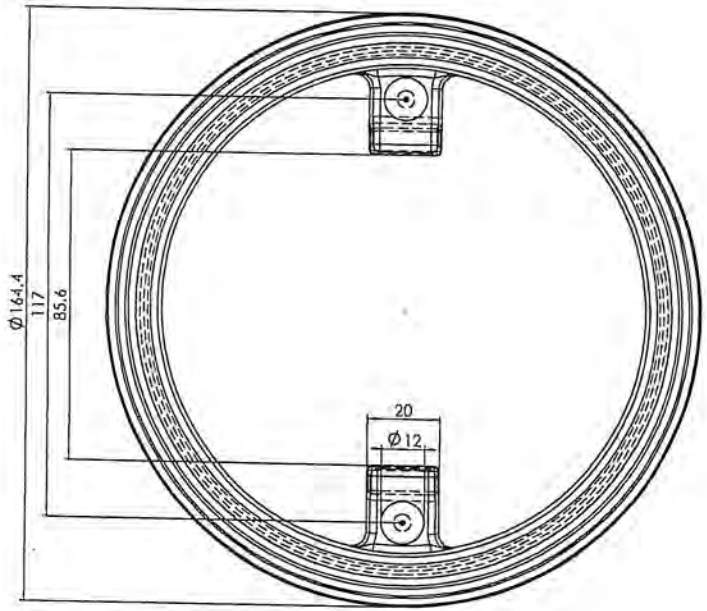
Date of print: 29-10-2007

1 - 26 OF 1 - 83









Ck'd TM Date 11/6/07

Constructional Drawing
25.10.2007

		Rev	Revisions		Sign.:
Drilling instructions 7.04.02			Title:	Construction:	KDU
Gen. without indication of margin acc. to ISO Norm No.: 8062 CT9			Røgtud 6100 NA	Released:	
Material:	Støbejern GG 15		Flue collar	Format:	A
Weight:	3,93 kg		Morsø 6100	Scale:	1
Model no.:	77			Remno.:	
Drawingtype:	Casting Drawing		morsø	Drawing no.:	6100-7
Location of file:					

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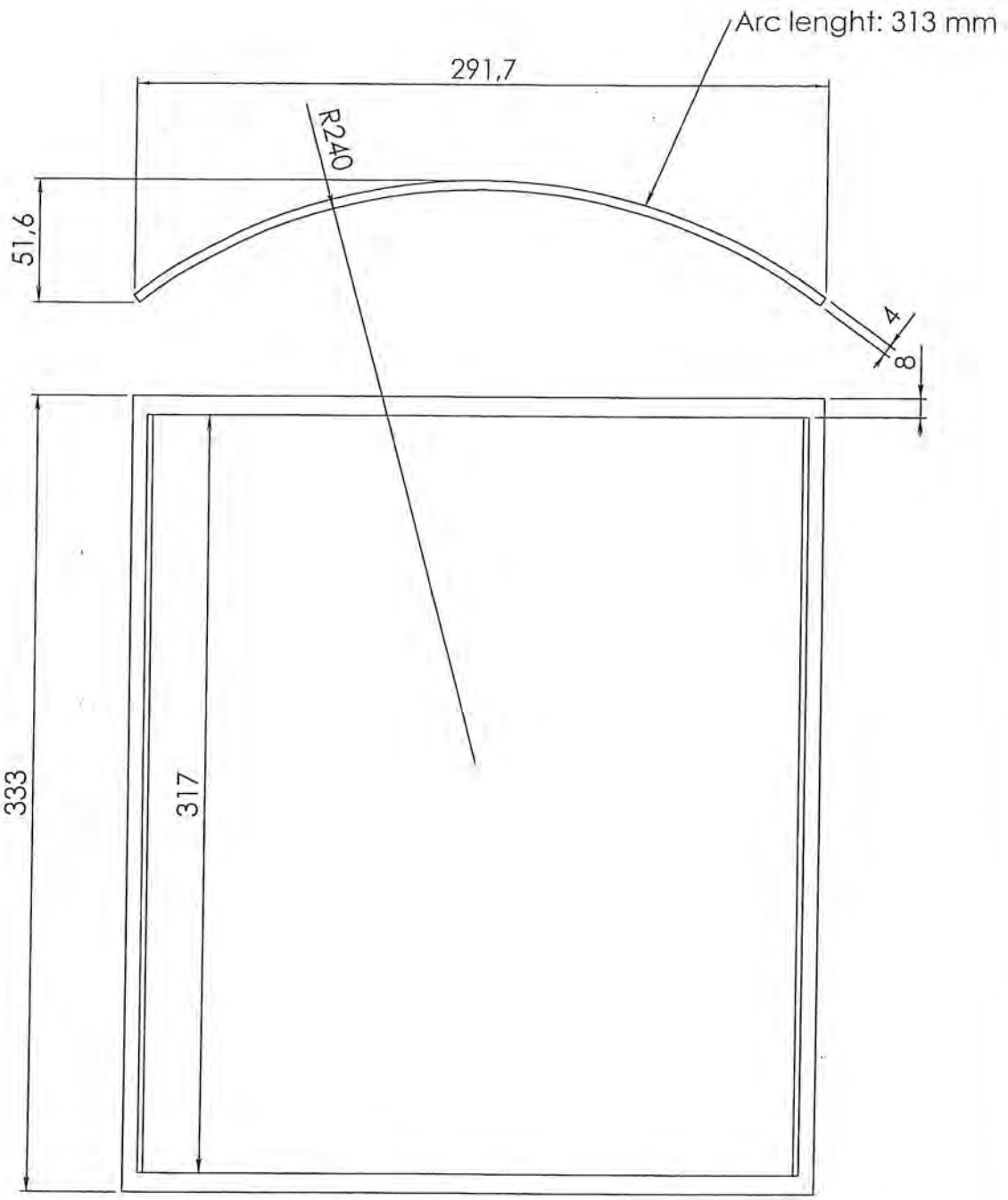
Date of print: 29-10-2007



Total lenght: 1260 mm

Rev.	Revisions	Sign.:	Date:

Dim. without indication of margin acc. to DS/ISO 2768-1 m	Title: Glasbånd m. tape / Glass gasket tape / Morsø 6100	Construction:	RSV	30.10.2007
		Released:		
Material: 8x4mm Glasbånd m. tape		Format:	A4	
Weight: 0,31 kg		Scale:	1:2.5	
Model no.		Itemno.:	79074200	
Drawingtype: Product Drawing	morsø	Drawing no.:	6100-84 a	
Location of file: U:\sw\Tegninger\s1001 6100-84 Glasbånd SLOPE				

Date of print: 08-11-2007

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GLASFIBERPRODUKTER
TEKNISKE DATA

Basismaterialet i **STEFFCA glasfiberprodukter** består af 6 - 9 mikron "E" glasfibertråde som kan volumineres, tekstureres, tvindes, forstærkes med ståltråde osv.
Produkterne er uorganiske, sterile, ildfaste, helt asbestfri, indeholder ingen giftstoffer eller tungmetaller, og forårsager ikke hudirritation.

"E" GLASFIBER - SAMMENSÆTNING

SiO_2	53-55 %
Al_2O_3	14-15,5 %
CaO - MgO	20-24 %
B_2O_3	6,5-9 %
Fe_2O_3 - TiO_2	< 1 %
Na_2O-H_2O	< 1 %

"E" GLASFIBER - GENERELLE EGENSKABER

Farve:	**HVID**
Max. temperatur	550 °C
Smeltepunkt	1200 °C
Fiberdiameter	6-9 mikron
Trækstyrke - nyt filament	3400 MPa
Young's modul	74000 MPa
Varmeledningsevne	1,0 W/m °K
Reaktion på ild	ildfast
Glødetab	< 1,5%
Dielektrisk stivhed	60-100 kV/mm
Opløsningsmiddelægthed	god
Basefasthed	god
Syrefasthed	god - bortset fra fluorbrintesyre

Ck'd PSS Date 11/6/07

"E" GLASFIBERPRODUKTER - GENERELLE EGENSKABER

- stor mekanisk styrke
- gode elektriske egenskaber
- ildfaste
- lav varmeledningsevne
- god modstandsevne over for kemiske stoffer
- høj termisk modstand
- god fleksibilitet

MAX TEMPERATUR ..... 550 °C

STEFFCA GLASFIBERPRODUKTER - SORTIMENT

Snoede pakning - omflettede pakning - isolerende bånd - flettede pakninger i runde, firkantede og rektangulære dimensioner - vævet bændel - selvklæbende bændel - bånd - selvklæbende bånd - stigebånd - dielektrisk tape - lodde puder - rå, silikonecoatede, HT-behandlede, aluminiserede, grafitiserede, karamelliserede, teflonbelagte, - glasklæder - afdækninger

VETRO-REF:
GLASFIBERPRODUKTER MED SPECIEL HT-IMPRÆGNERING

Glasfiberprodukter kan imprægneres med speciel ildfast vermiculit for at øge deres resistens over for høje temperaturer og alle slags termisk chok op til 1000°C og for at reducere spild af glasfiber og pulver under håndteringen.
STEFFCA's "VETRO-REF" produkter er meget fleksible og modstandsdygtige over for gnister, svejsesprøjt og smeltet metal.

VETRO-REF produkternes farve	**guld**
Imprægneringens max termiske fasthed ved kontinuerlig anvendelse	700° C
Imprægneringens max termiske fasthed ved kortvarige påvirkninger	1000 °C

Steffca A/S - [illegible]stervej 10 H – 5800 Nyb[illegible] CVR-Reg. Nr. 24 44 93 – [illegible]. Nr. 20 76 85 09
Telefon [illegible] – Telefax [illegible] – E-mail info@steffca – www.steffca.dk

Fra: Martin Steffensen [Martin@steffca.dk]
Sendt: 25. marts 2004 13:04
Til: kaa@morsoe.com
Emne: Data E-glas Eng.
Hermed data som aftalt.

GLASS FIBER TEXTILE PRODUCTS

The base material of **STEFFCA Glass Fiber Textile Products** consists of 6 - 9 microns "E" Glass Fiber Filament Yarns that can be voluminized, texturized, plyed, reinforced with steel wire etc.

They are inorganic, steril, incombustible, totally Asbestos-Free, do not contain any toxic matter nor heavy metals and do not cause skin irritations.

BASIC COMPOSITIONS OF "E" GLASS FIBER

- SiO2 53-55 %
- Al2O3 14-15,5 %
- CaO - MgO 20-24 %
- B2O3 6,5-9 %
- Fe2O3-TiO2 < 1%
- Na2O-K2O < 1%

Ck'd RSS Date 11/6/07

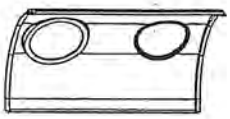
GENERAL PROPERTIES OF "E" GLASS FIBER

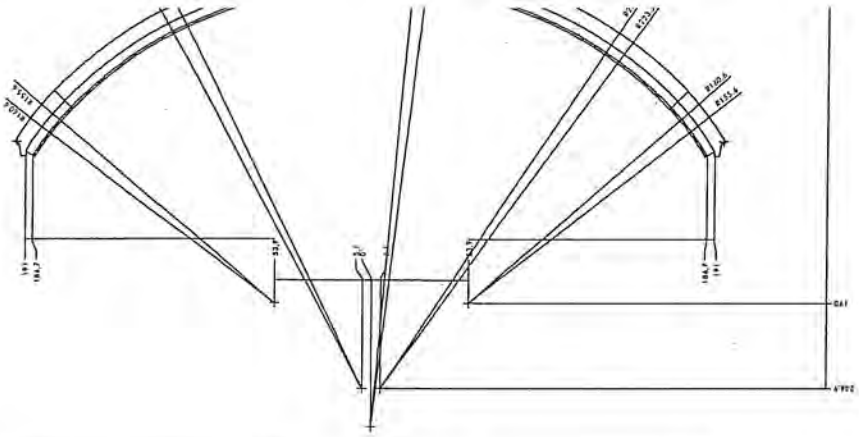
- Max. Temperature 550°C
- Melting Point 1200 °C
- Diameter-*filaments* 6-9 micron
- Tensile strength-*virgin filament* 3400 MPa
- Young's modulus 74000 MPa
- Thermal conducivity 1,0 W/m °K
- Fire reaction incombustible
- Loss on ignition < 1,5 %
- Dielectric rigidity-*glass in bulk* 60-100 KV/mm
- Solvent resistence good
- Bases resistence good
- Acid resistence good - except fluoridric acid

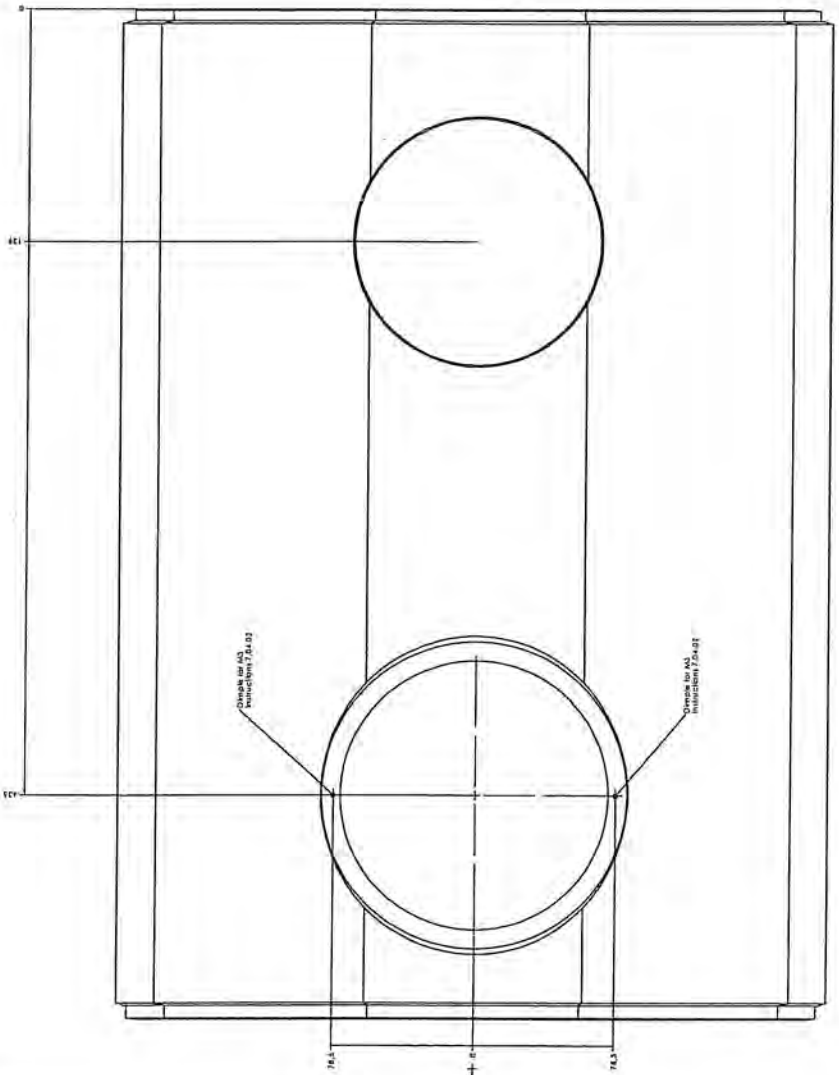
GENERAL PROPERTIES OF "E" GLASS FIBER TEXTILE PRODUCTS

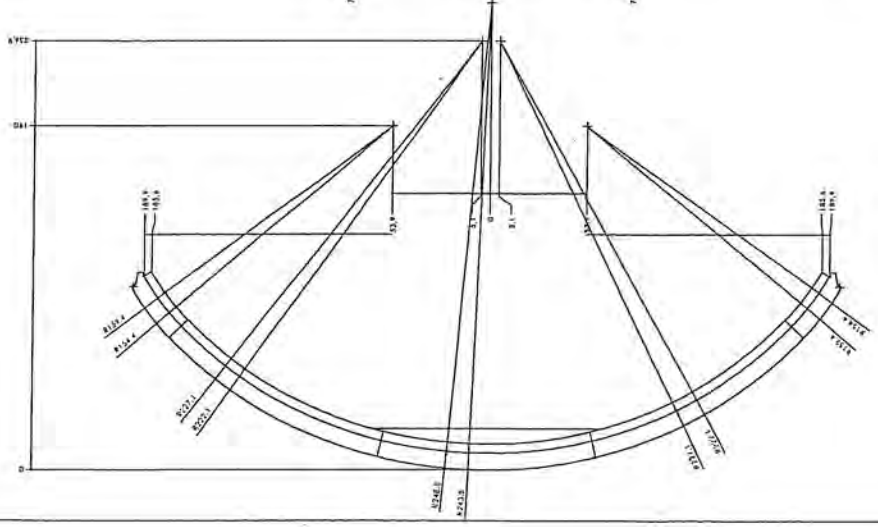
- - high mechanical strength - good electrical properties
- - incombustible - good dimensional stability
- - low thermal conducivity - good resistence to chemical agents
- - high thermal resistencs - - good flexibility
- - max temperature 550°C

Ck'd RGS Date 11/6/07

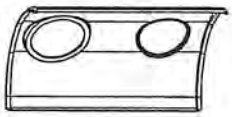


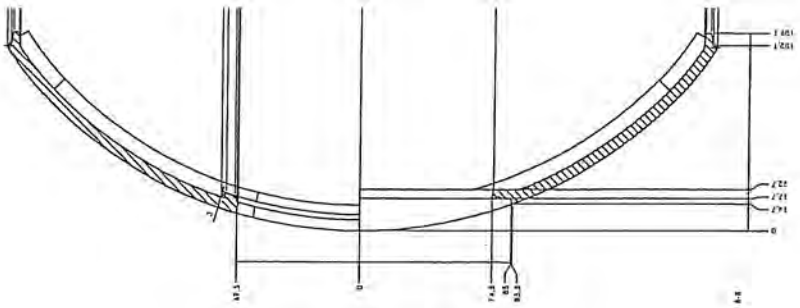




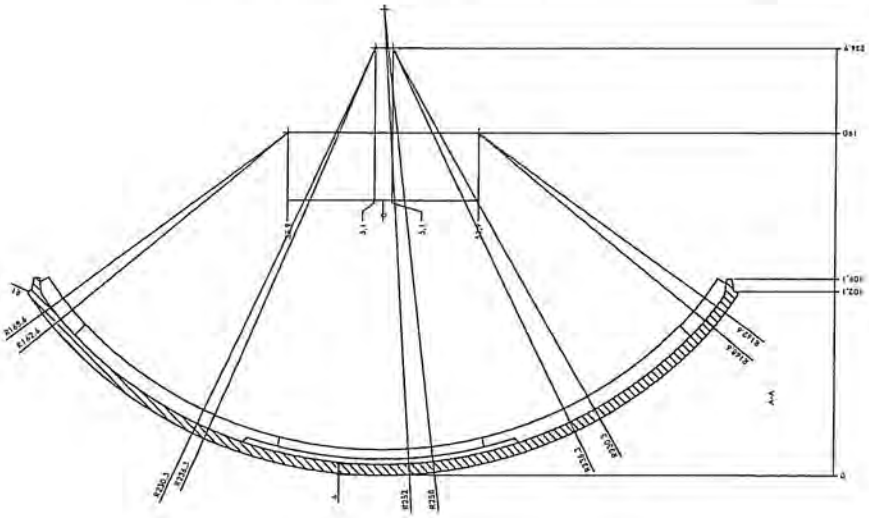


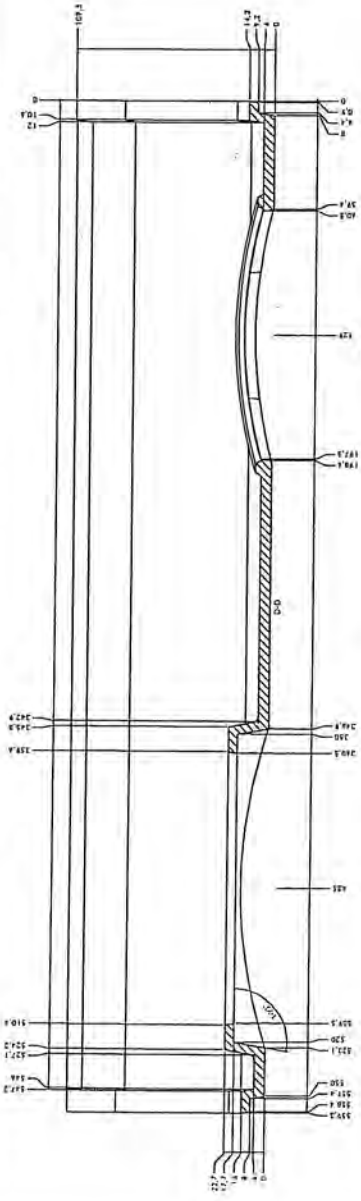
Ck'd PS Date 11/6/07

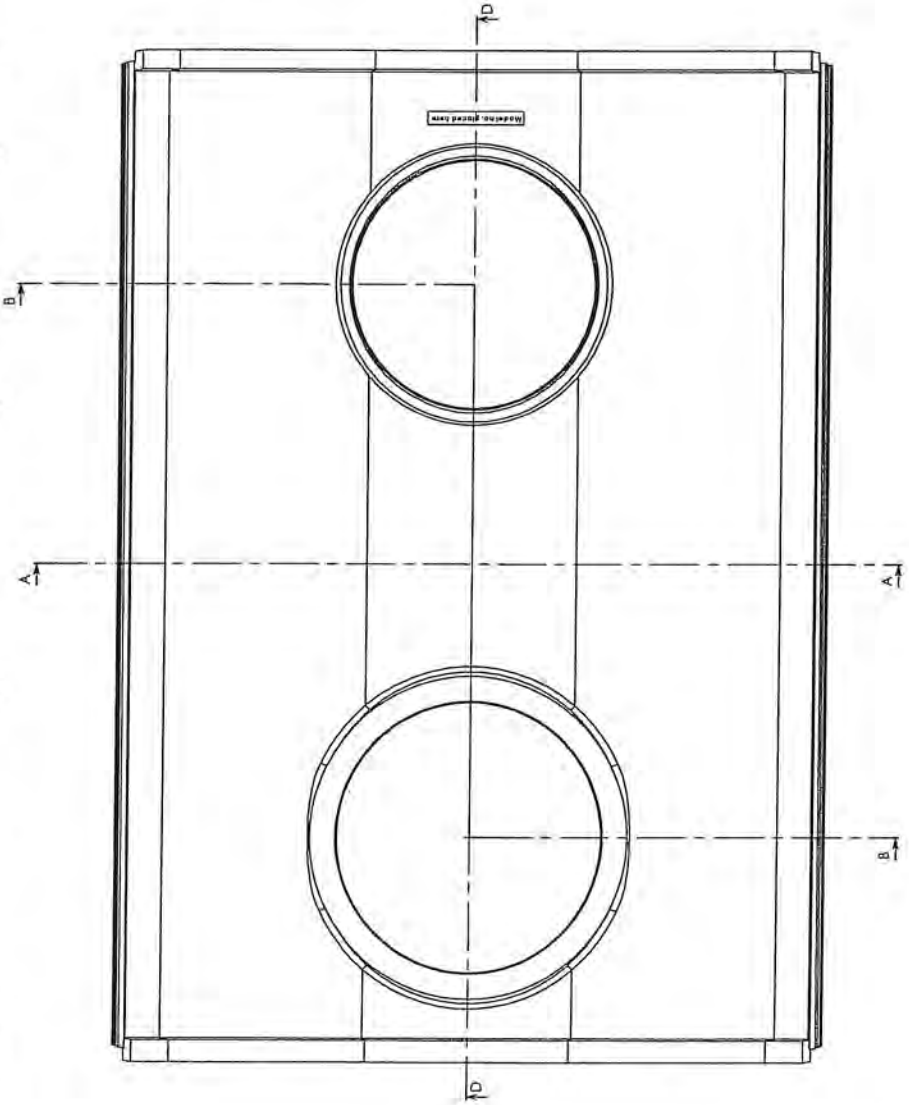


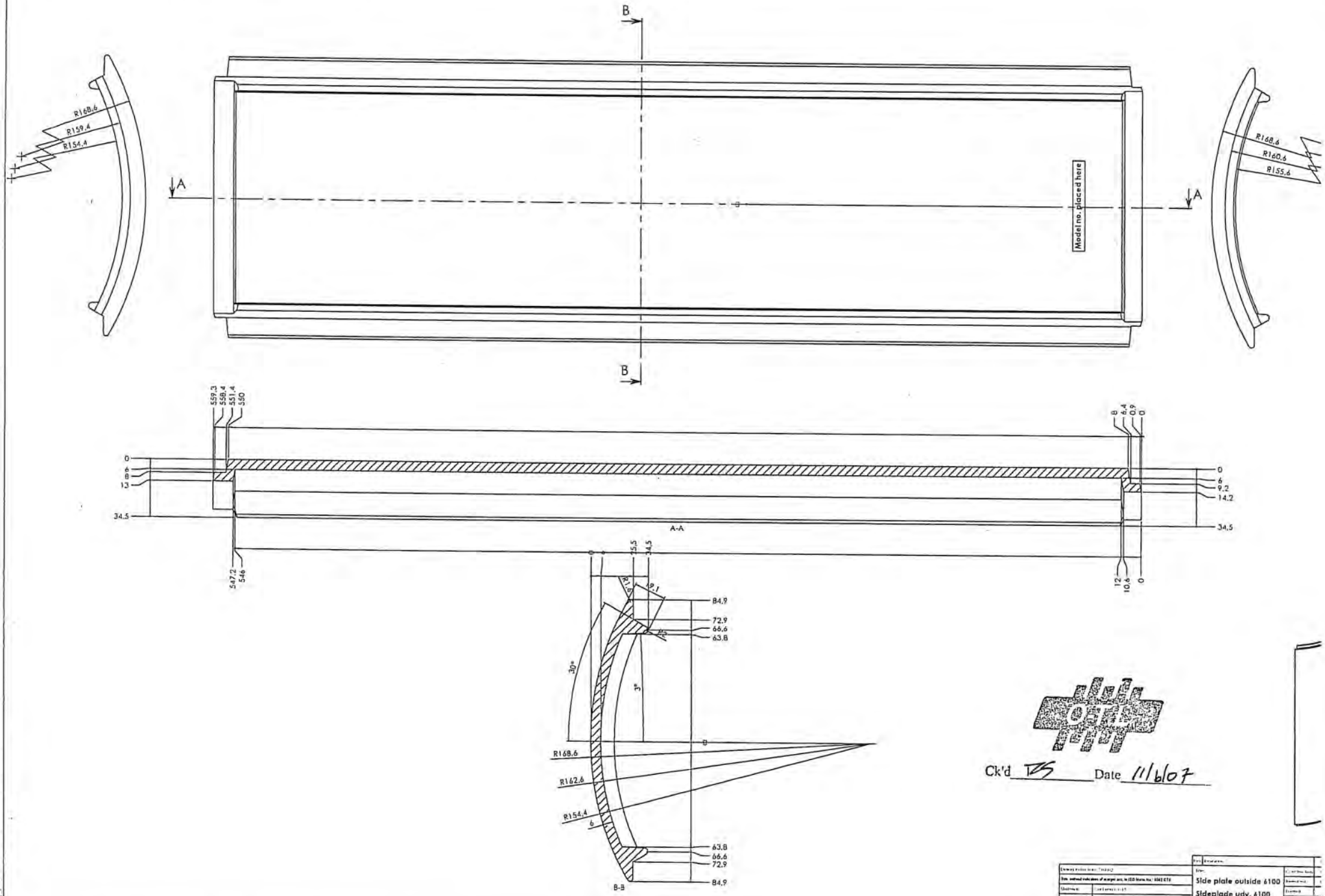


Ck'd DS Date 11/8/11





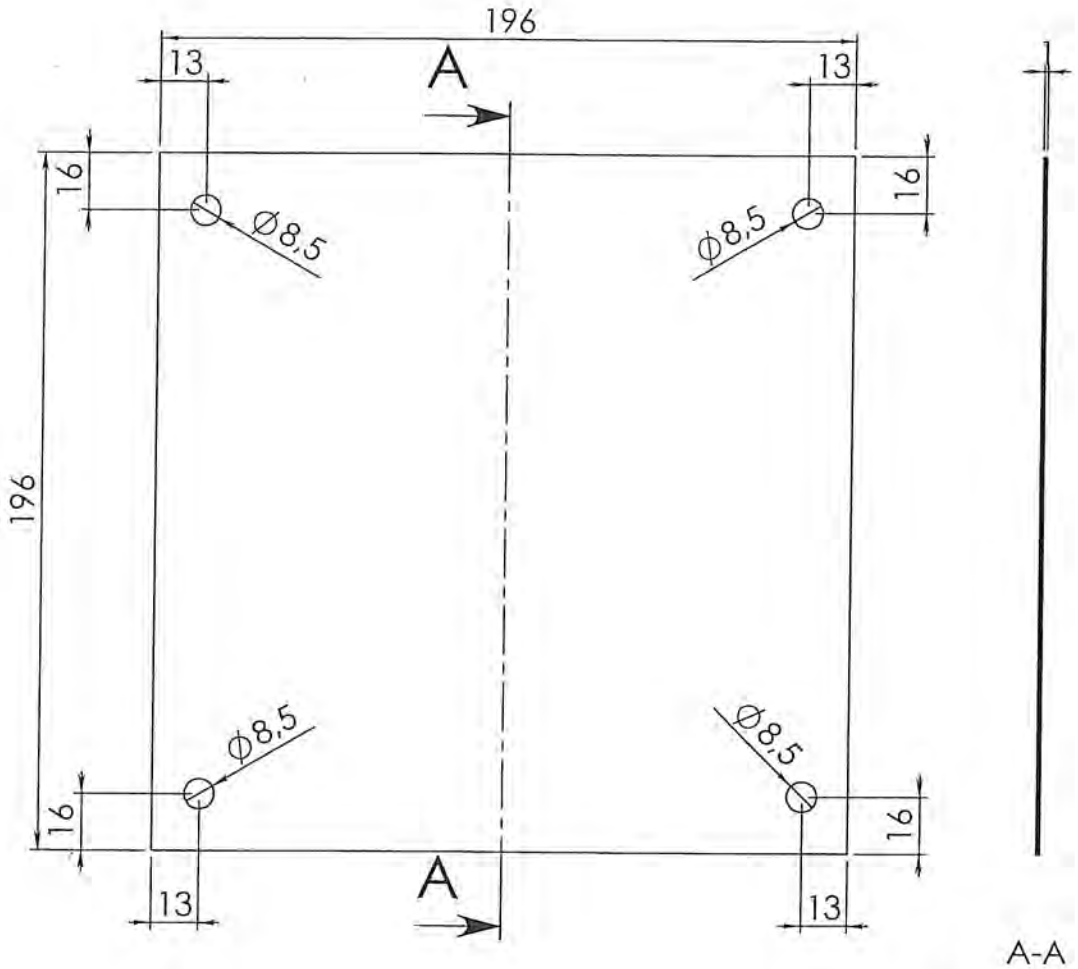




Ck'd TS Date 11/6/07

Side plate outside 6100	
Sideplade udv. 6100	
Morsø 6100	
morsø	6100

1 - 34 OF 1 - 83



Ck'd RS Date 11/6/07

Constructional Drawing
31.10.2007

Rev.	Revisions	Sign.:	Date:

Dim. without indication of margin acc. to DS/ISO 2768-1 m	Title: Stråleplade bund / Radiant shielding, bottom	Construction:	RSV	31.10.2007
		Released:		
Material: Galvaniseret plade		Format:	A4	
Weight: 0,3 kg		Scale:	1:2	
Model no.		Itemno.:	71612500	
Drawingtype: Product Drawing	morsø	Drawing no.:	6100-87	
Location of file: U:\cdv\Tegninger\6100\6100-87 Stråleskærm bund A4\2.SLDPRT				

Date of print: 31-10-2007

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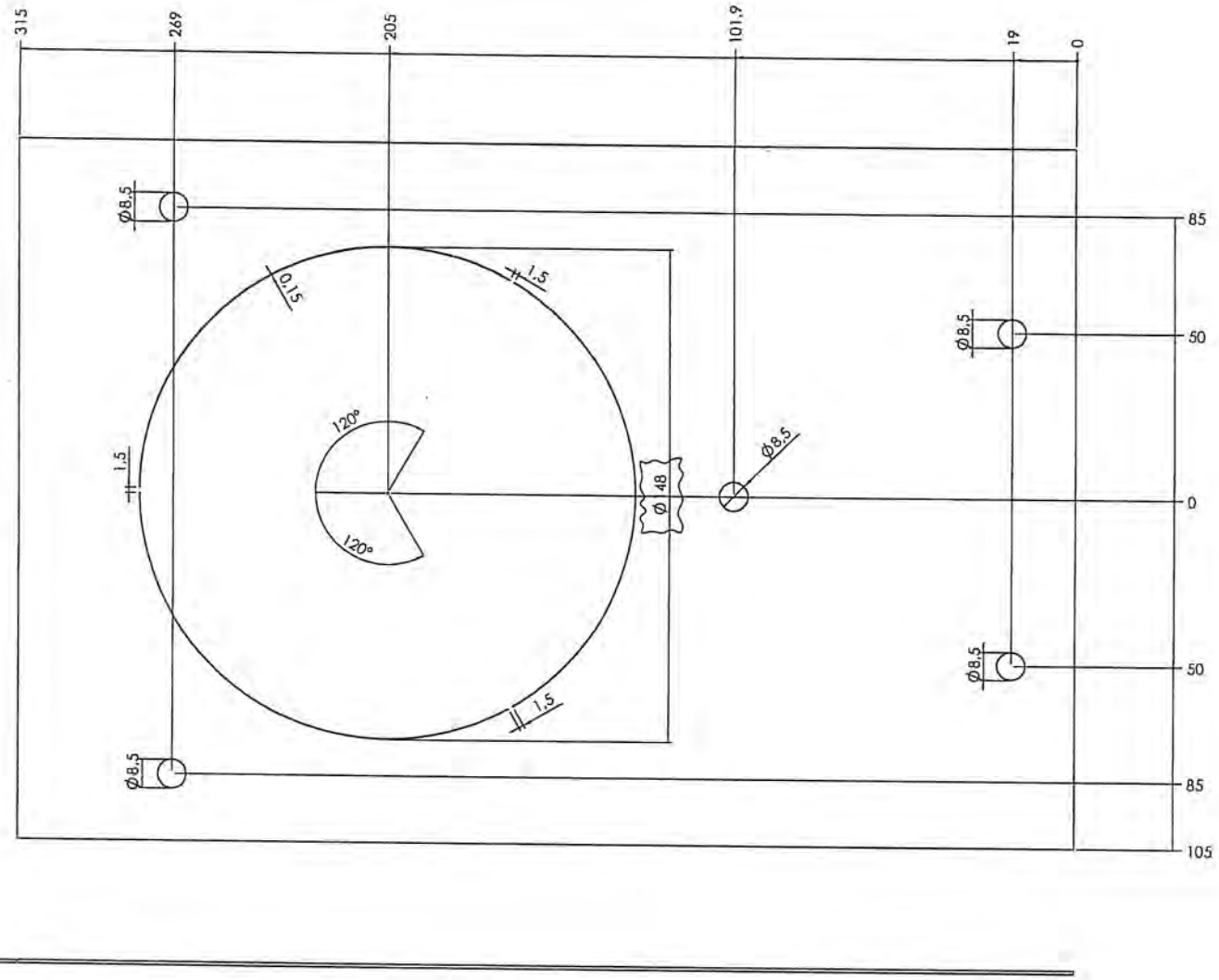

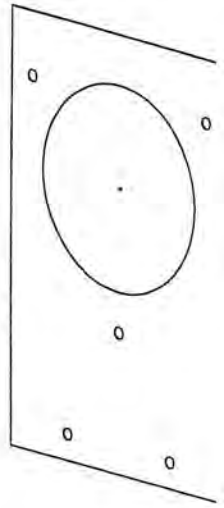

Ck'd PS Date 11/6/07

b	"Hul" for reglud øgal 3mm i diameteren.		KDU
Rev.	Revisions		Sign.
	Title: Stråleskærm bag 6170 / Radiant shielding, rear / Morsø 6100	Construction:	KDU
		Released:	KDU
		Format:	
		Scale:	
		Item no.:	716
	morsø	Drawing no.:	6100-7

Mål uden toleranceangivelse iht. DS/ISO 2768-1 m	
Material:	Galvaniseret plade
Weight:	0,52 kg
Model no.	-
Drawingtype:	Product Drawing
Location of file:	

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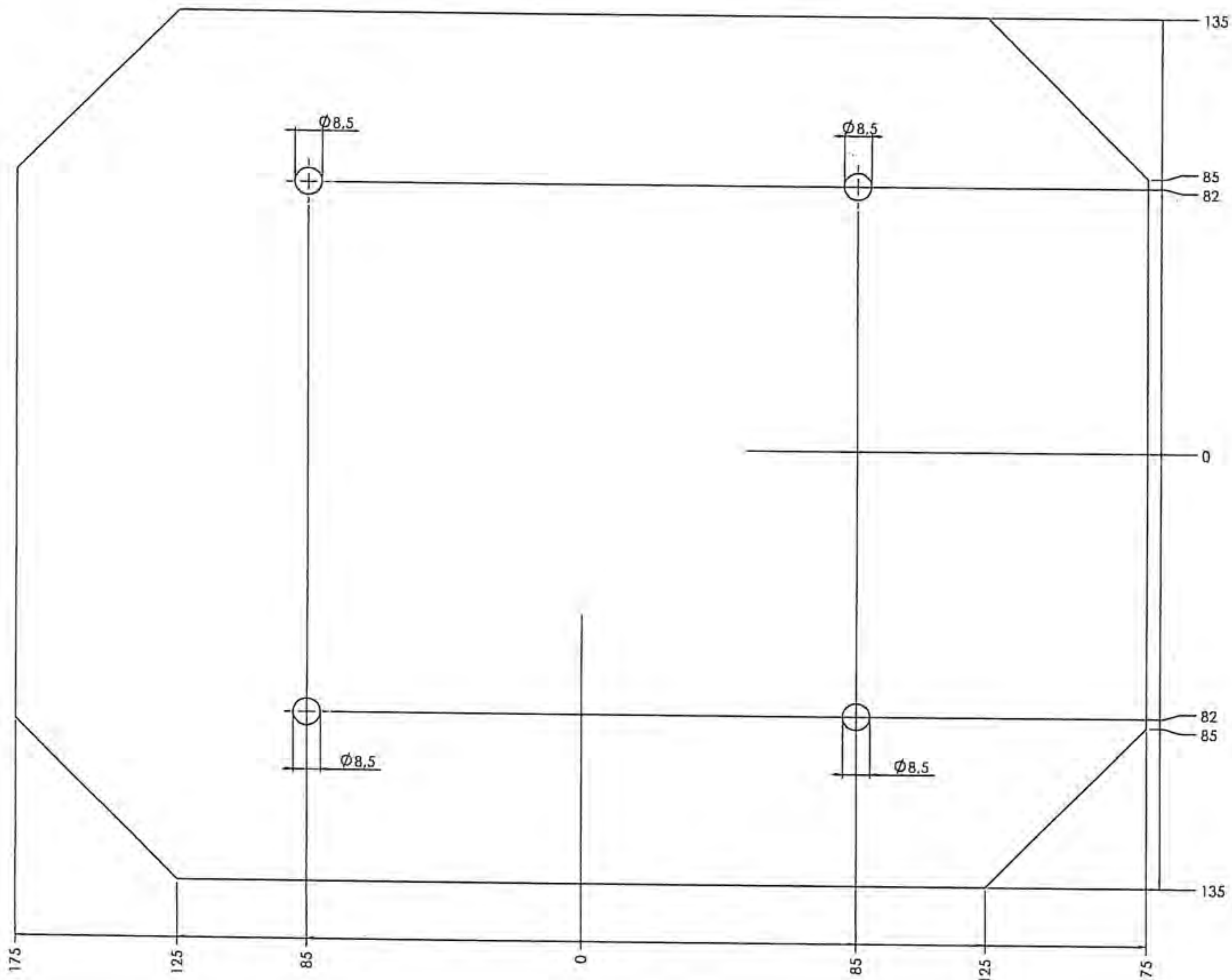

Ck'd RS Date 11/6/07

		Rev. Revisions			Sign.:
		Title:		Construction:	KDU
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m		Stråleskærm bund 6100		Released:	KDU
Material:	Galvaniseret plade	Radiant shielding, botto[m]		Format:	
Weight:	0,7 kg			Scale:	
Model no.:	-	Morsø 6100		Remno.:	7161
Drawingtype:	Emnetegning	morsø		Drawing no.:	
Location of file:					6100-28

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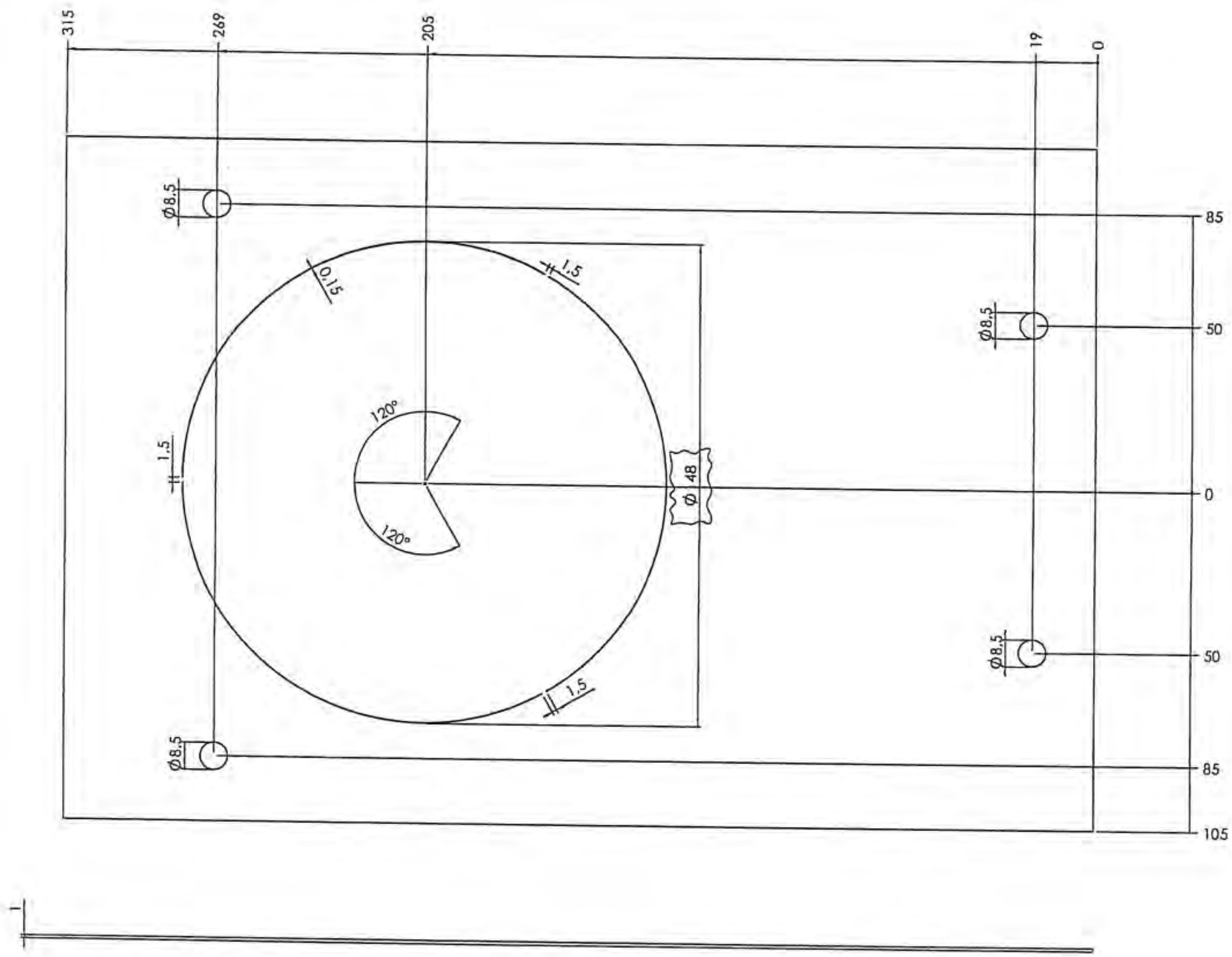

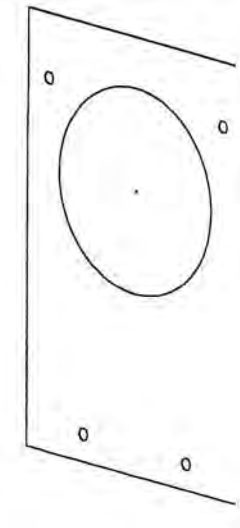

Ck'd ZS Date 11/6/07

b	"Hul" for reglud eget 3mm i diameteren.		KDU
Rev.	Revisions		Sign.:
Title:		Construction:	KDU
Stråleskærm bag 6100		Released:	KDU
Radiant shielding, rear		Format:	
Morsø 6100		Scale:	
		Remno.:	7161
morsø		Drawing no.:	6100-27

Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	
Material:	Galvaniseret plade
Weight:	0,52 kg
Model no.:	-
Drawingtype:	Emnetegning
Location of file:	

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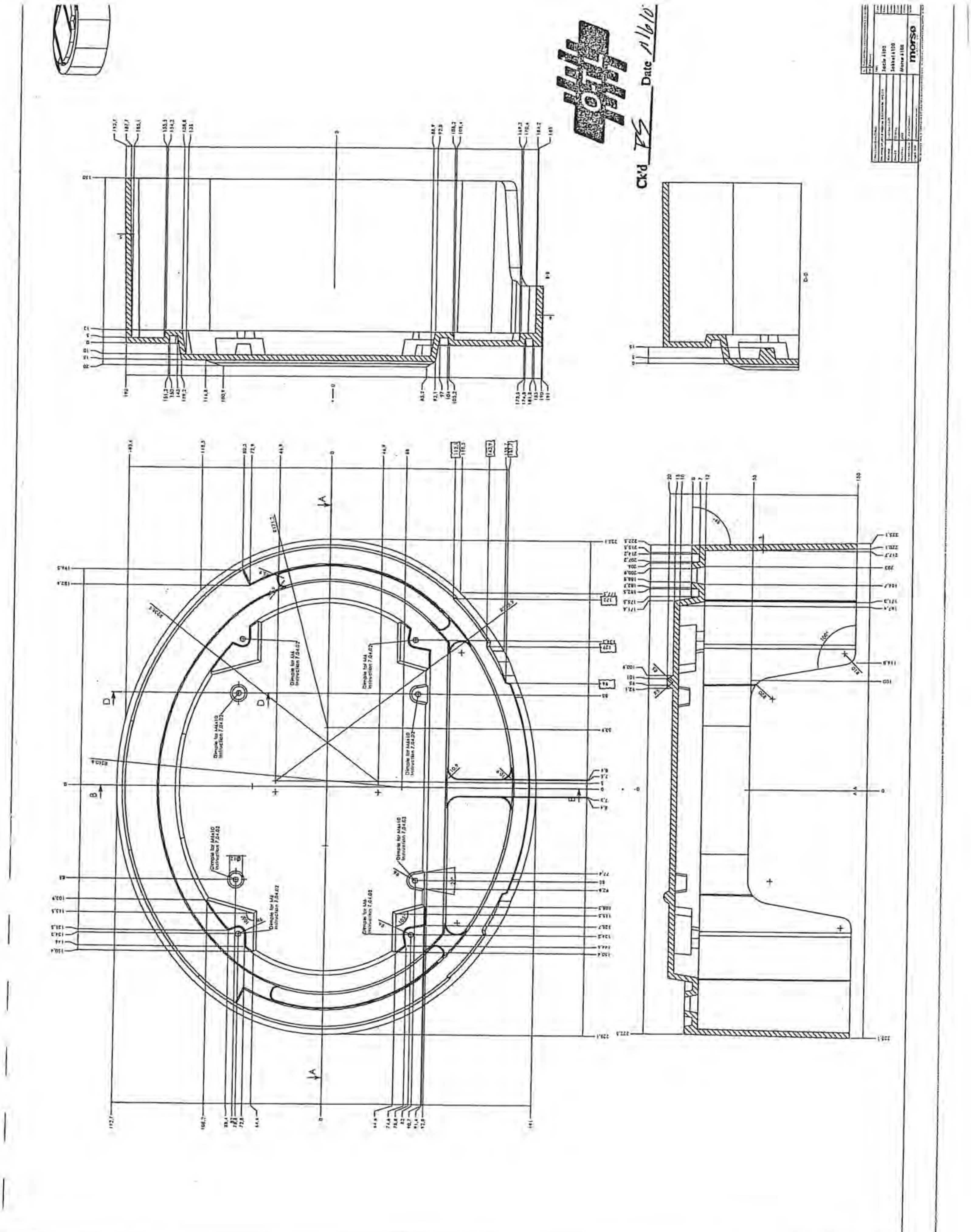
Engineering Drawings/Blueprints (Remainder)

PARTS:	DRAWINGS:	DATE:
Socle	6100-01	30.11.2006
Front frame	6100-02	14.03.2007
Door	6100-03	01.01.2006
Rear plate, inside	6100-04	01.06.2006
Top plate, inside	6100-05	01.06.2006
Top frame	6100-06	01.06.2006
Side plate, outside	6100-07	01.06.2006
Rear plate, outside	6100-08	01.06.2006
Top plate, outside	6100-09	01.06.2006
Intermediate frame	6100-10	01.06.2006
Air canal, front	6100-11	01.06.2006
Air canal, rear	6100-12	01.06.2006
Air canal, top	6100-13	01.06.2006
Base plate	6100-15	01.06.2006
Ceramic glass	6100-20	01.03.2007
Brick, side, right	6100-21	30.05.2006
Brick, side, left	6100-22	30.05.2006
Brick, back	6100-23	30.05.2006
Baffle plate, bottom	6100-24	30.05.2006
Baffle plate, top	6100-25	30.05.2006
Ash tray	6100-26	30.05.2006
Radiant shielding, rear	6100-27	30.05.2006
Radiant shielding, bottom	6100-28	30.05.2006
Fitting plate f. baffle	6100-29	26.09.2007
Secundary box	6100-30	30.05.2006
Closing fitting	6100-32	30.05.2006
Closing plate f. primary draught control	6100-33	30.05.2006
Round plate	6100-36	30.05.2006
Primary draught control	6100-37	01.06.2006
Handle f. primary draught control	6100-38	30.05.2006
Pedestal	6100-41	30.05.2006
Wall fitting	6100-58	27.09.2007
Stop bar	6100-64	13.09.2006
Fitting f. wall fitting	6100-71	19.09.2007
Radiant shielding, rear	6100-72	16.10.2007
Flue collar	6100-76	25.10.2007
Handle	6100-77	27.08.2007
Axle f. handle	6100-78	27.08.2007
Socle, plate	6100-80	31.10.2007
App. drawing 6140 NA	6100-81	26.10.2007
App. drawing 6148 NA	6100-82	29.10.2007
App. drawing 8170 NA	6100-83	29.10.2007
Tightening tape	6100-84	30.10.2007
Air flowdiagram	6100-85	30.10.2007
App. drawing 6143 NA	6100-86	29.10.2007
Radiant shielding, bottom	6100-87	31.10.2007
Parts drawing	6100-501	30.10.2007
Hinge pin	1126-38	20.12.1996
Distance tube	1126-71	21.11.2003
Cover	1400-10	02.12.1992
Log for plate - not threaded	1400-199	03.03.2000
Distance tube	1400-300	13.01.1997
Distance tube	1400-315	04.05.2006
Cover	8100-20	25.04.2006
Fitting f. hinge pin	8100-30	29.09.2005
Distance tube	8100-31	29.09.2005
Distance tube	8100-32	29.09.2005
Glass fitting	8100-132	06.03.2006

V-1100 (600) Vermiculite insulating slabs- Technical datas
Glas fiber products – Technical datas
Glass ceramics - Technical datas
Installation and Operating Instructions
Parts list 6140,6143,6148 & 6170

Ck'd TG Date 11/6/07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Date
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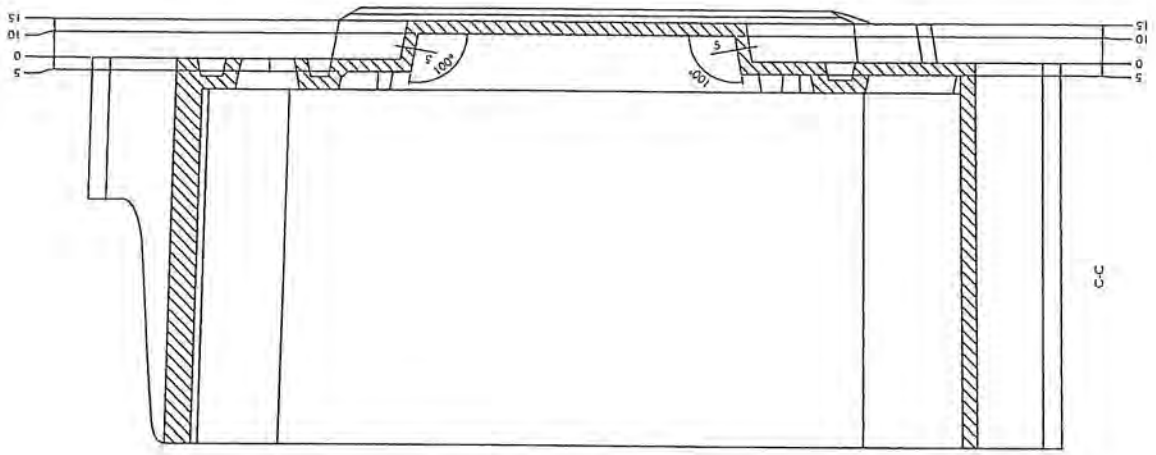
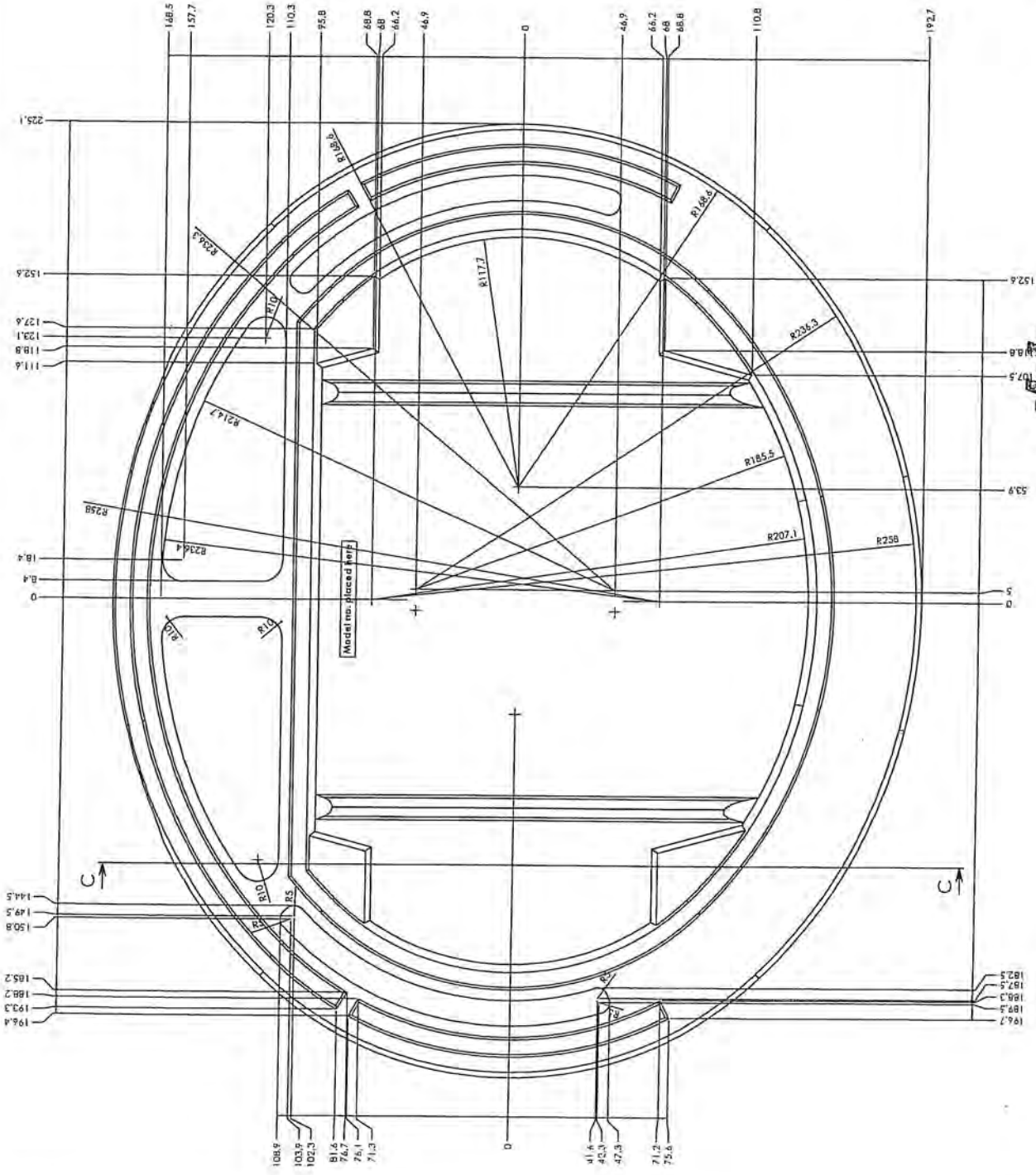
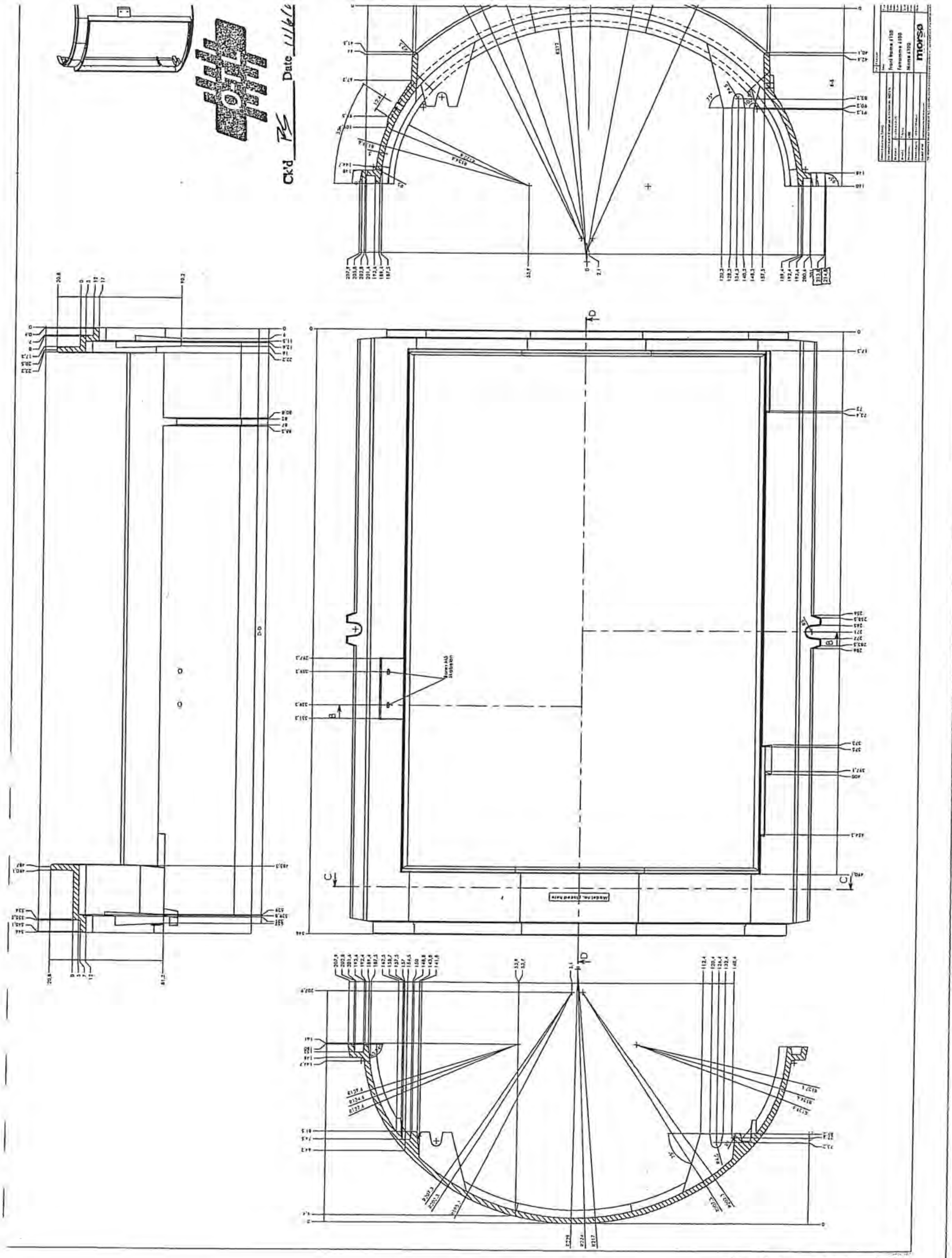
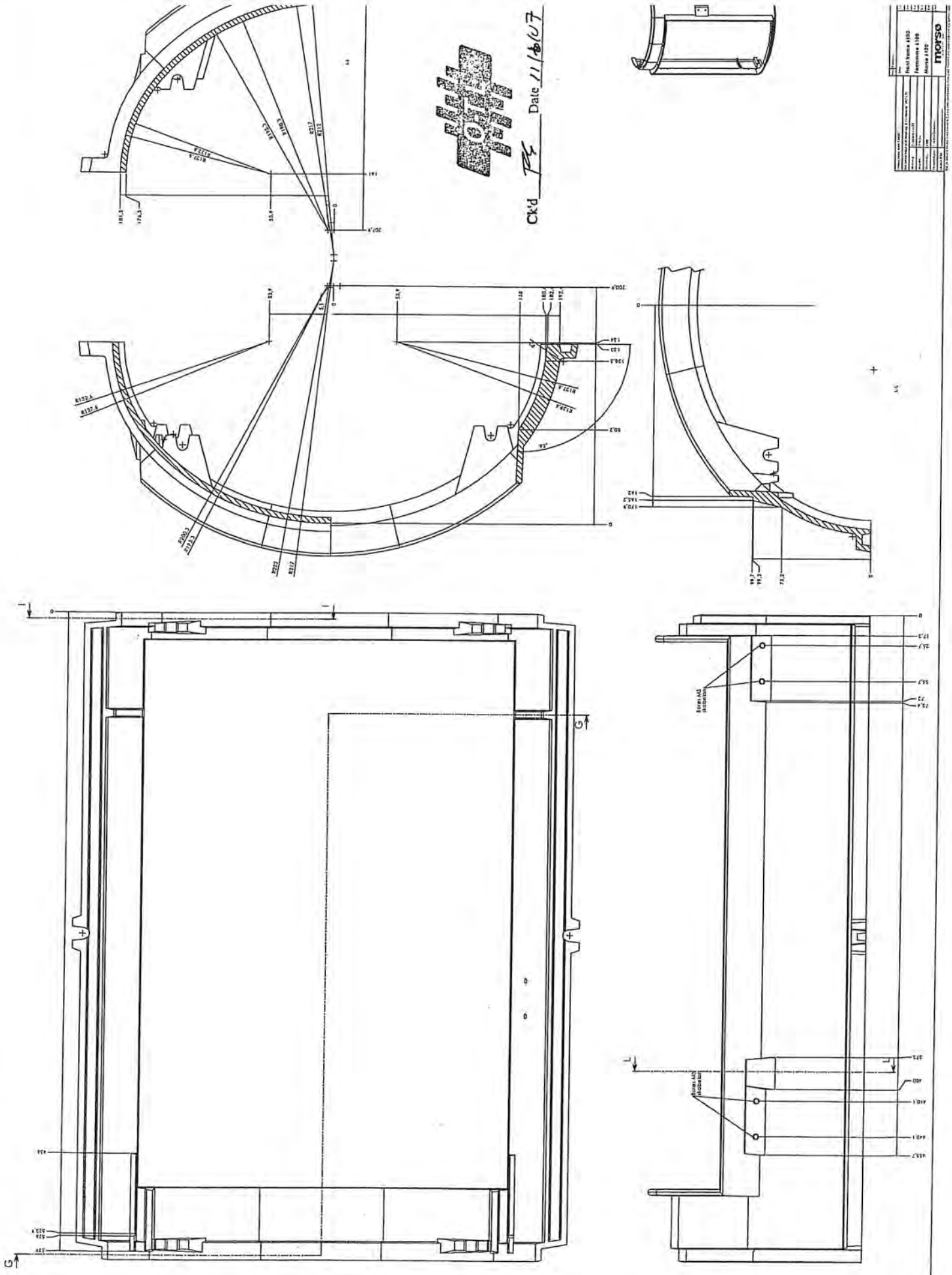




Ck'd Date 11/19

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Date 11/06/07
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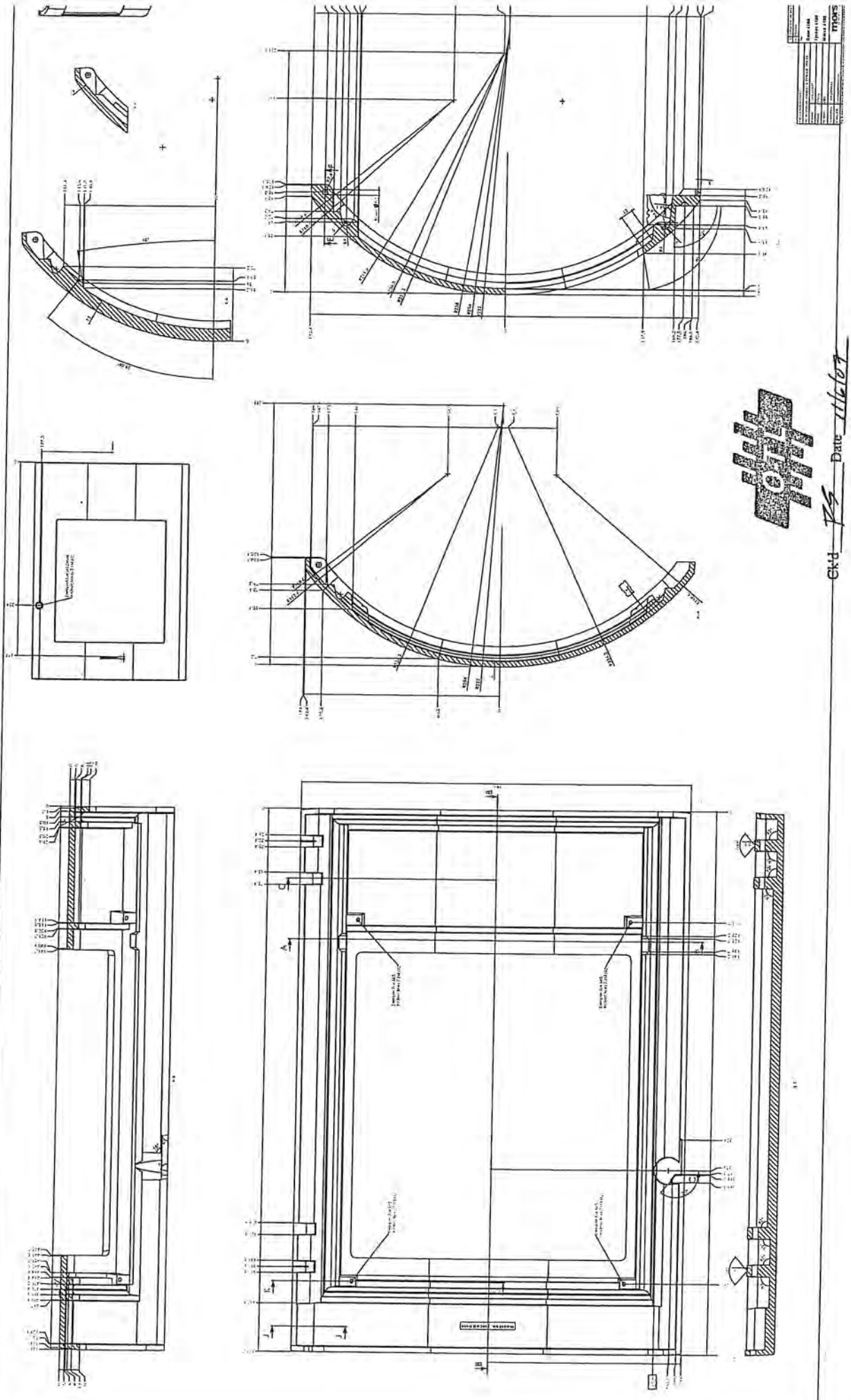
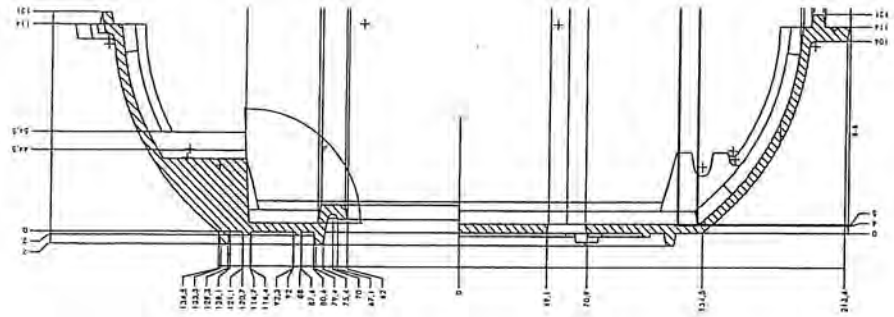
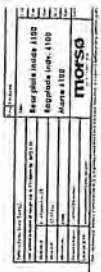
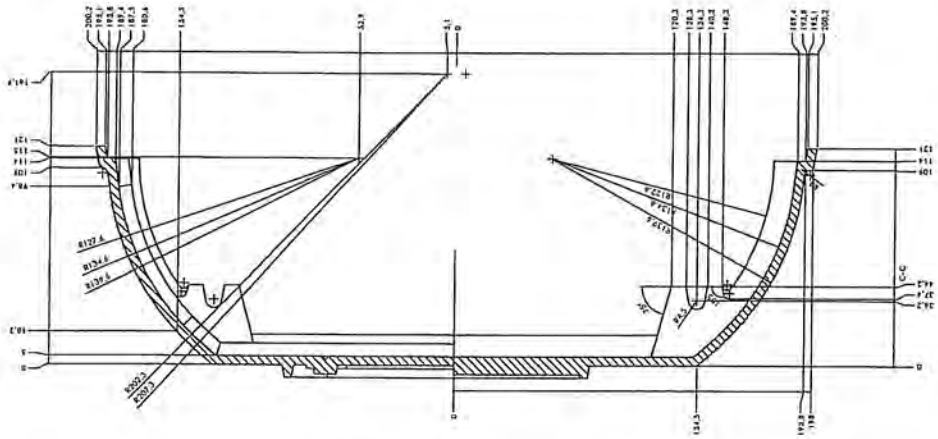


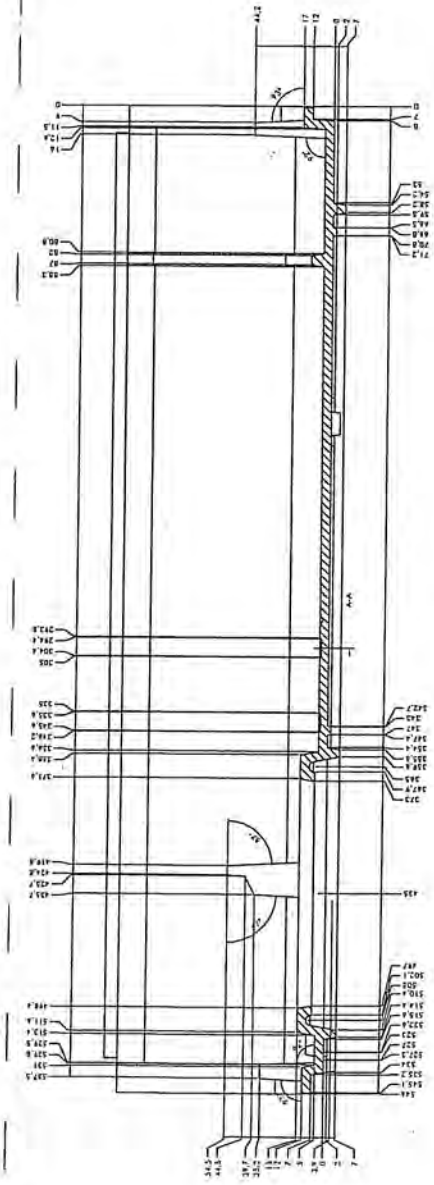
Ckd PS Date 11/6/97

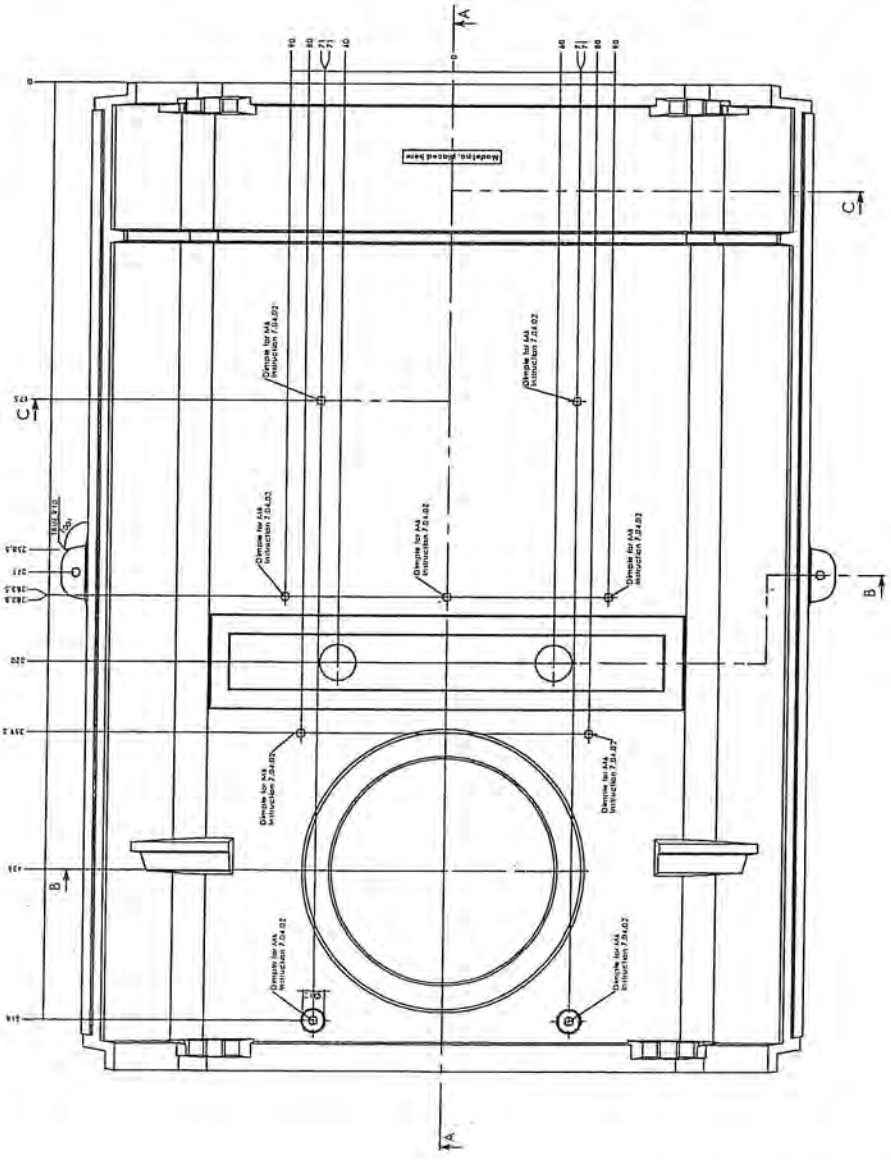


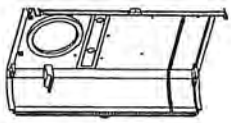


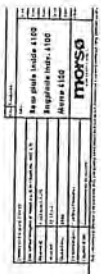
Ck'd Date 11/6/92

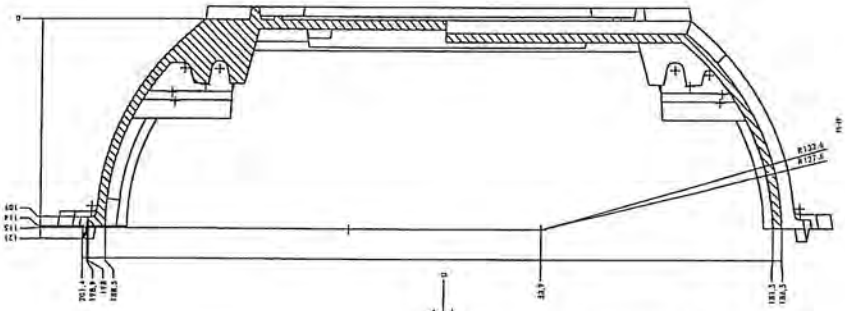


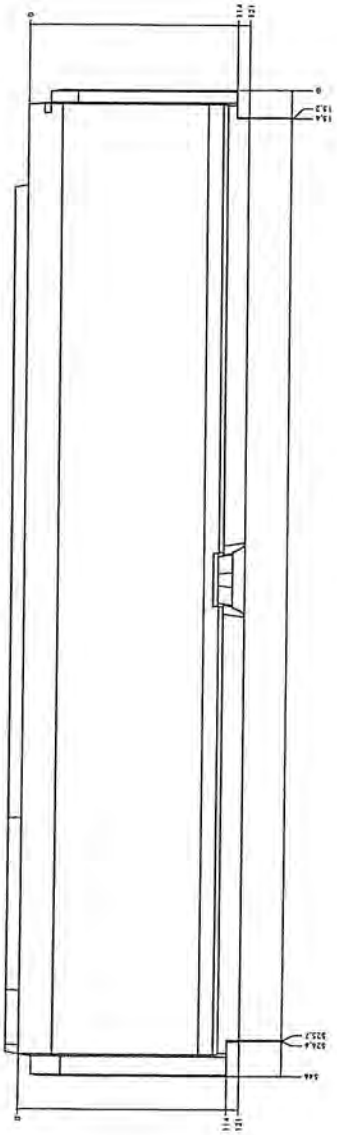


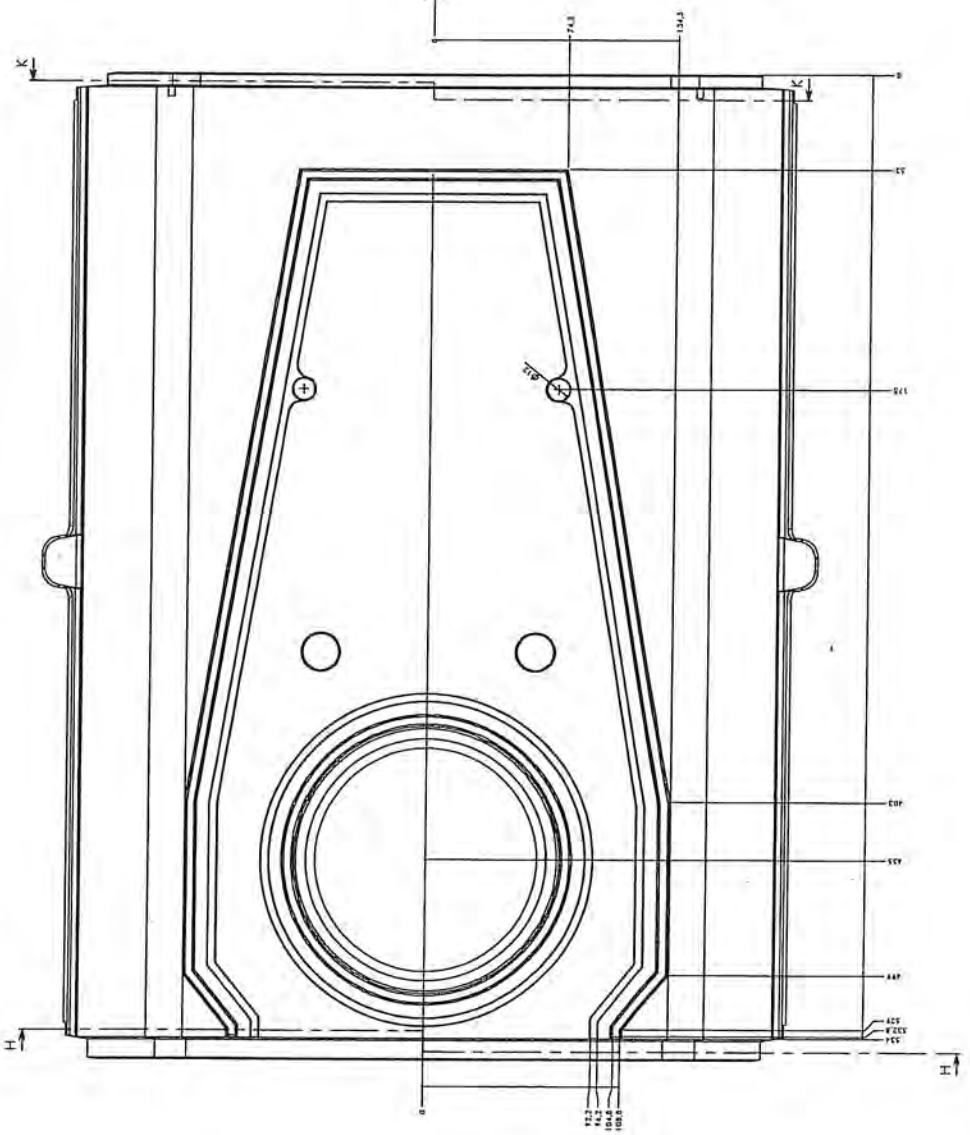


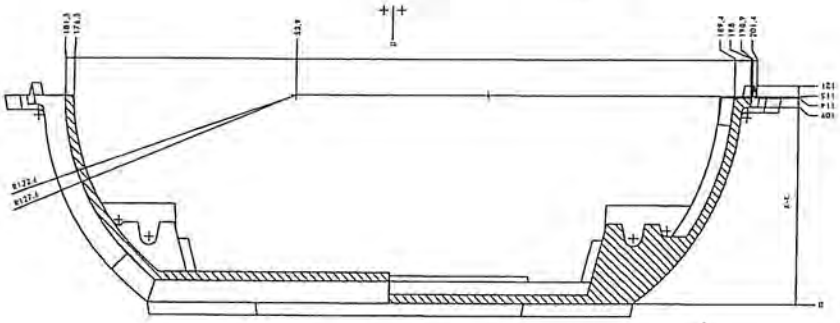




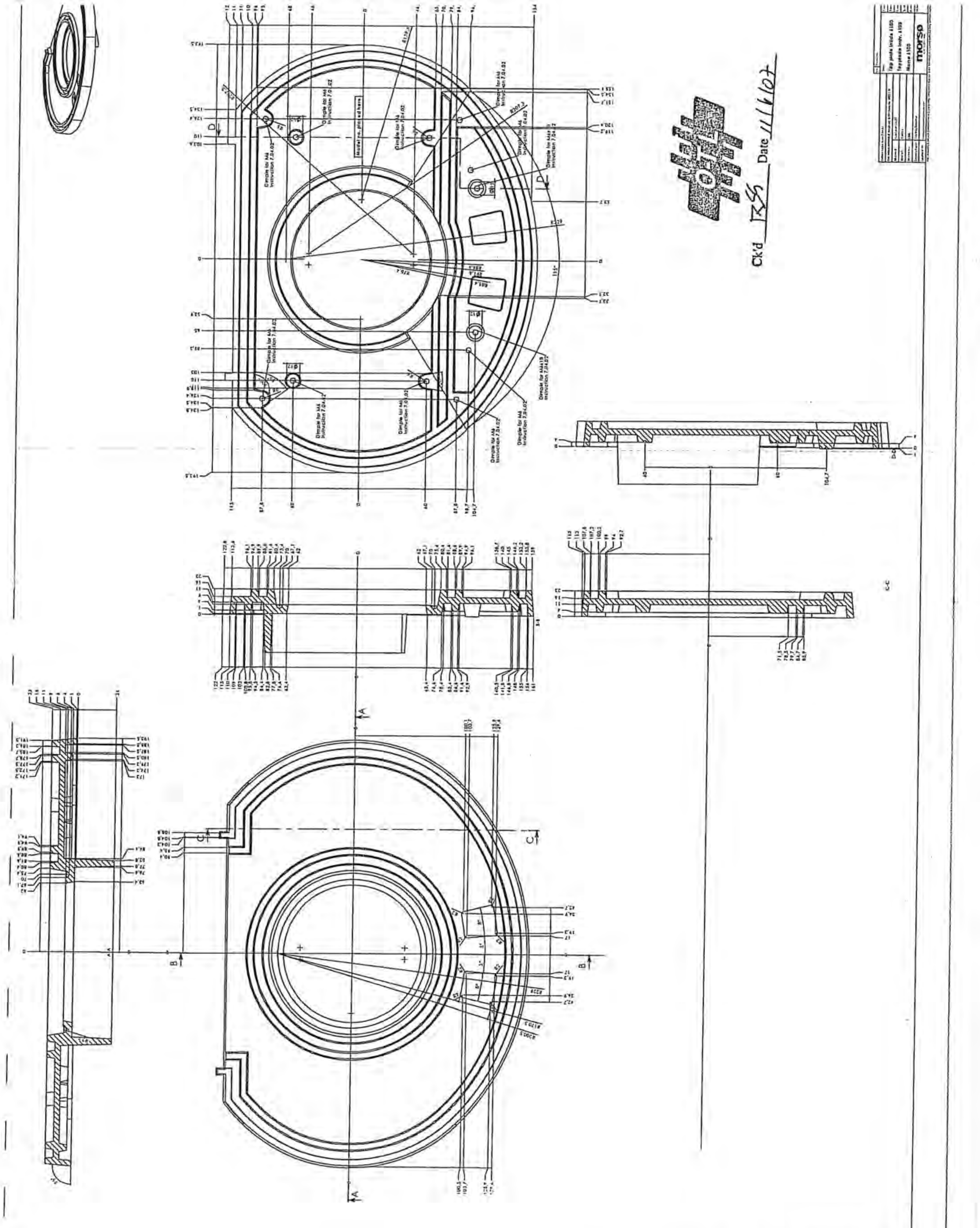


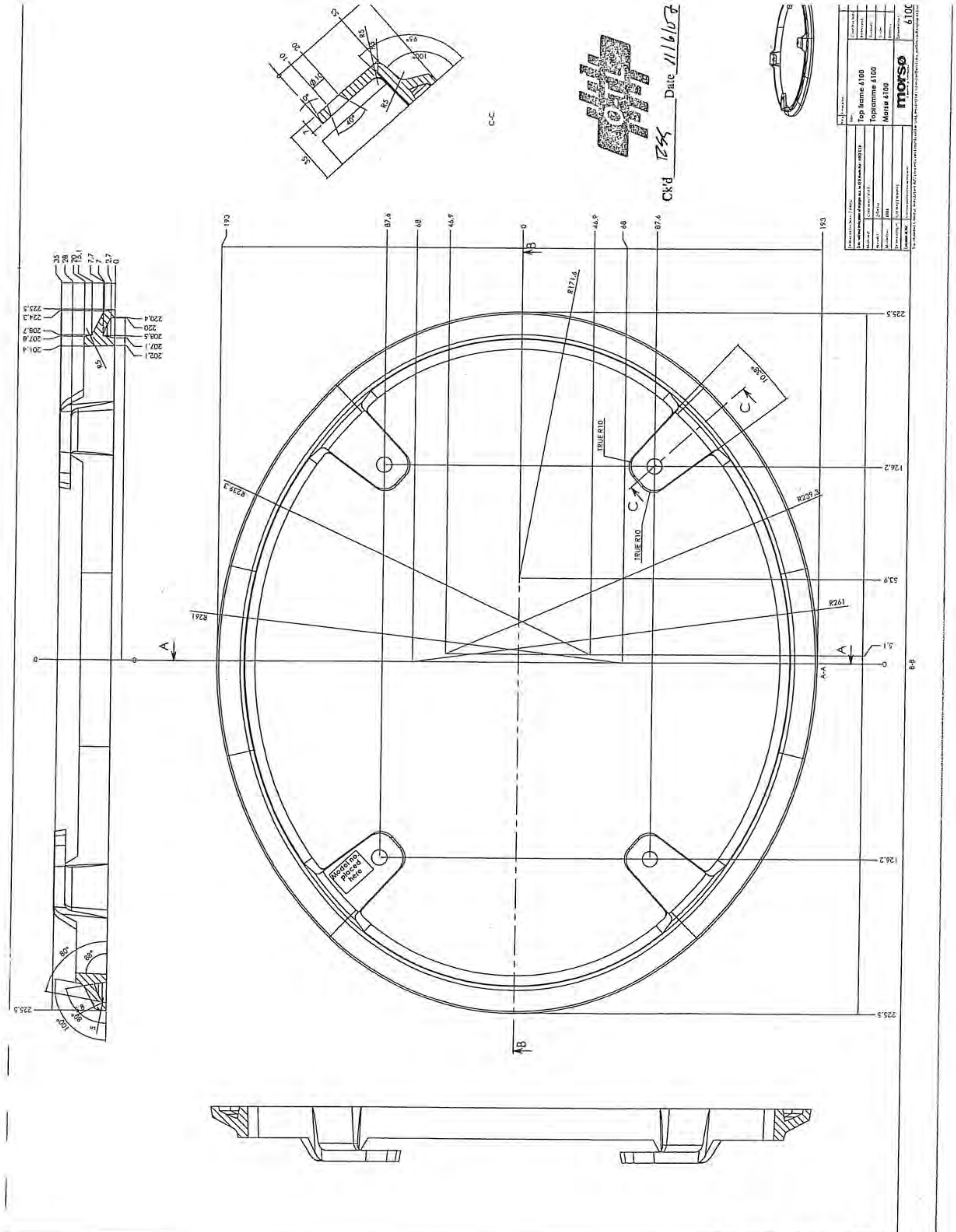


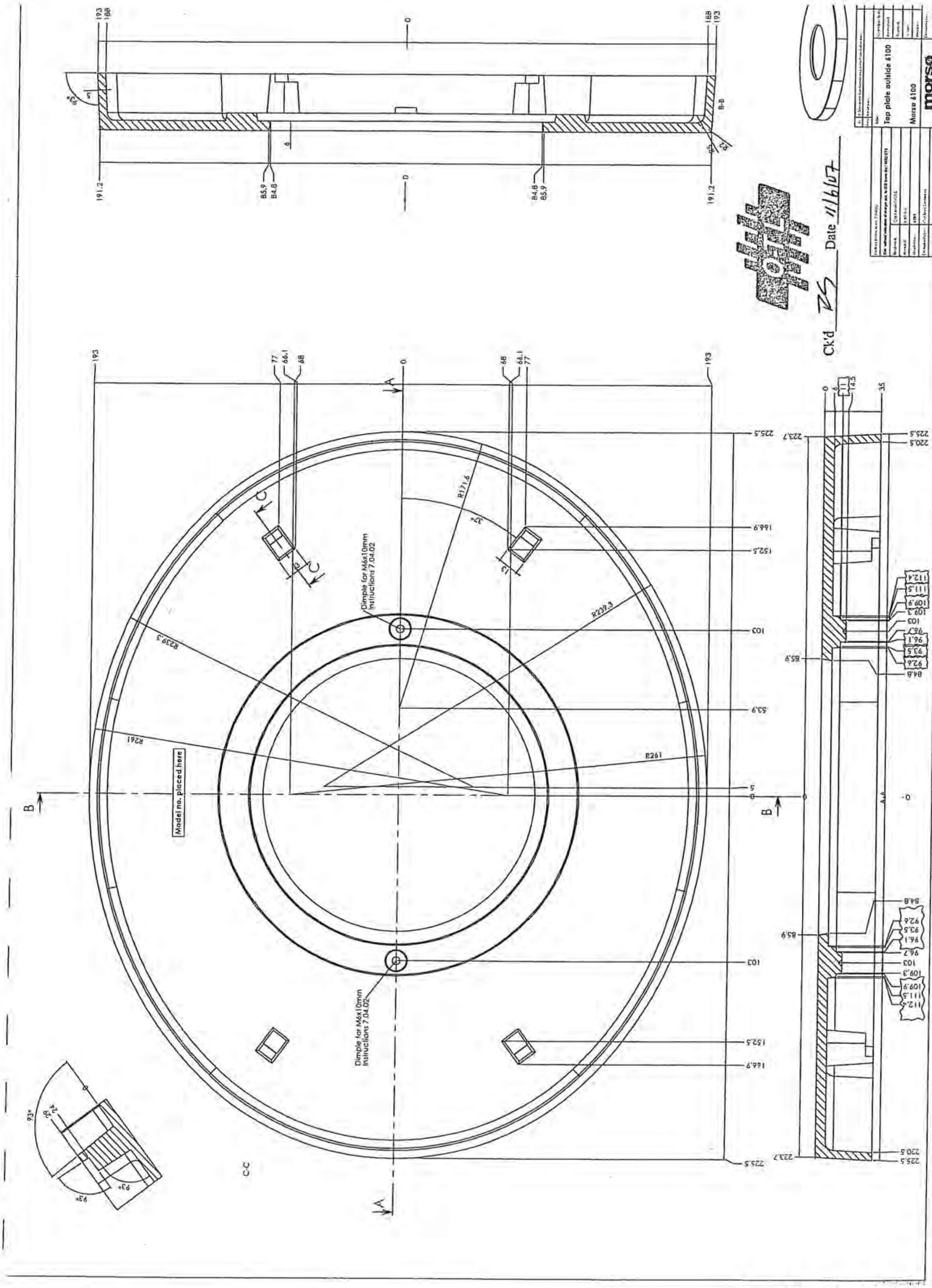


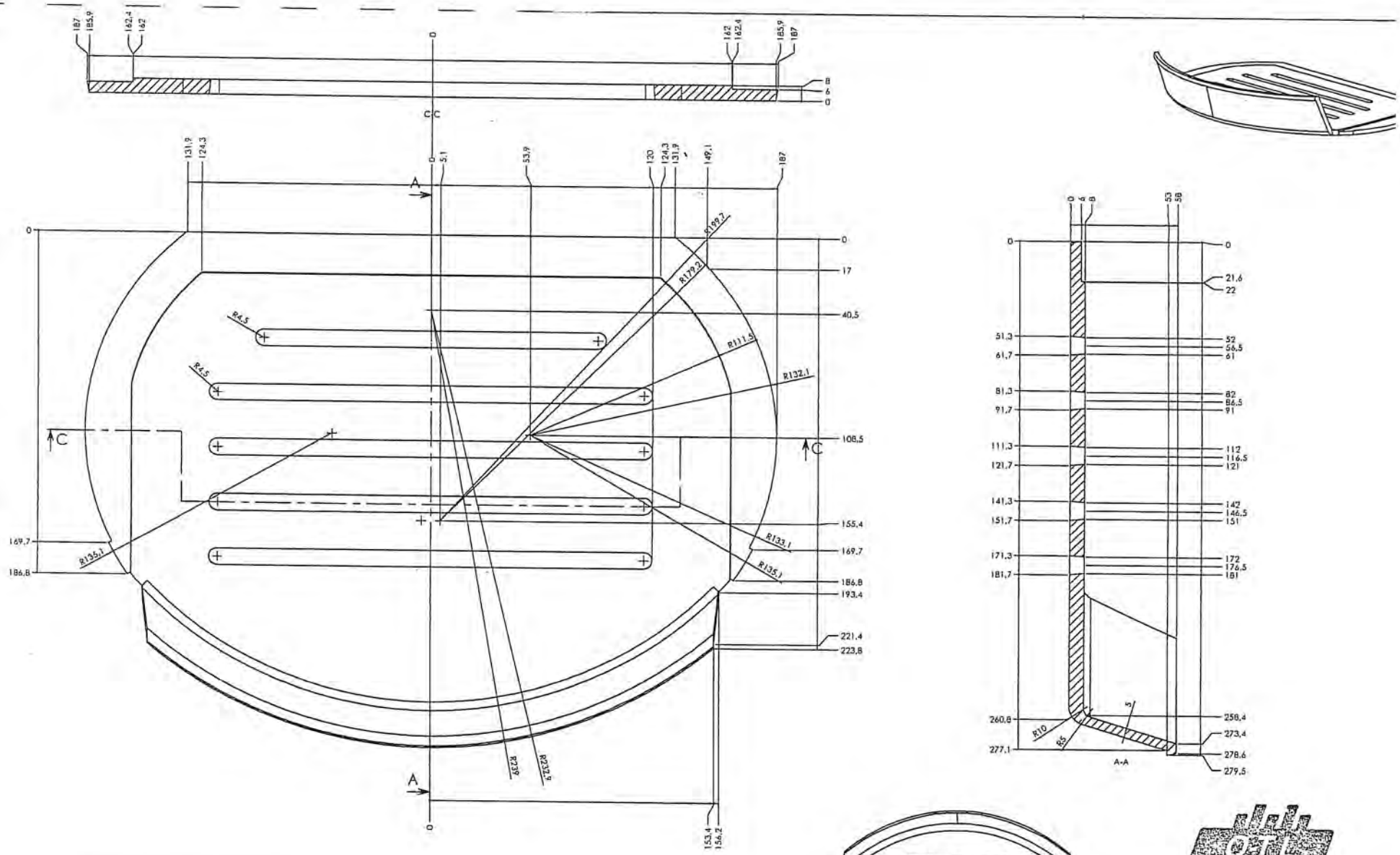


Ck'd Date 11/10/07


Ck'd RS Date 11/1/07


Top frame 6100
Topramme 6100
Morsø 6100
morsø
6100
C-C
A-A
B-B
TRUE R10
R171,6
R239,3
R261
10,36°
Model no. placed here
Ck'd
Date 11/6/07


Top plate outside 6100
Morsø 6100
morsø
Dimple for M6x10mm Instructions 7.04.02
Dimple for M6x10mm Instructions 7.04.02
Model no. placed here
Ck'd
Date 11/6/07
R261
R261
R239,3
R239,3
R171,6
B-B
A-A
C-C



Ck'd Date 11/6/07

Title:	Intermediate frame 6100
	Mellembund 6100
	Marsø 6100
Drawing no.	6100

morsø

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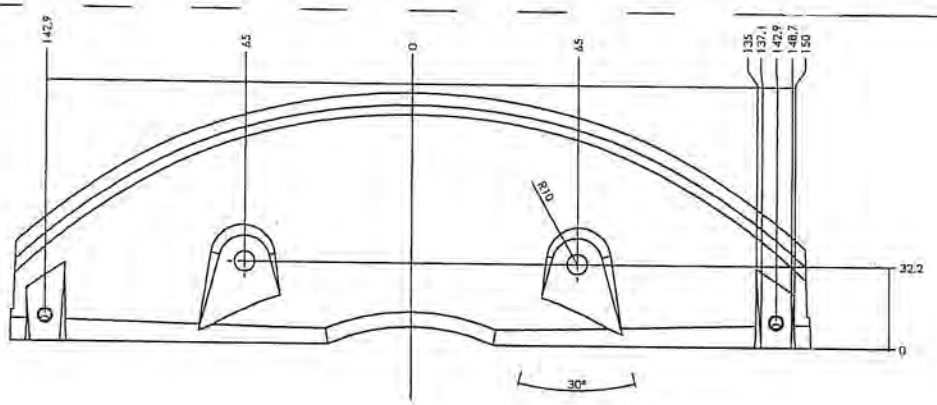
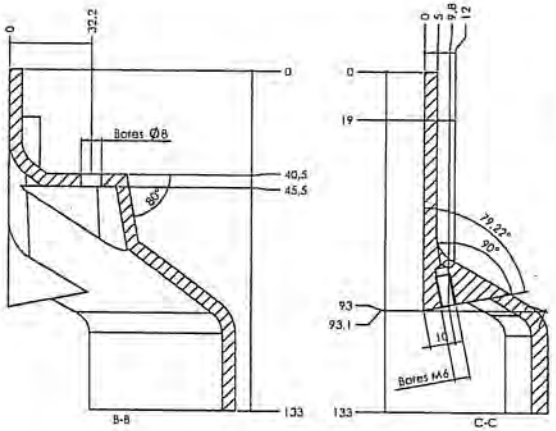
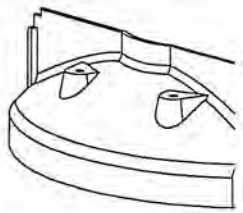
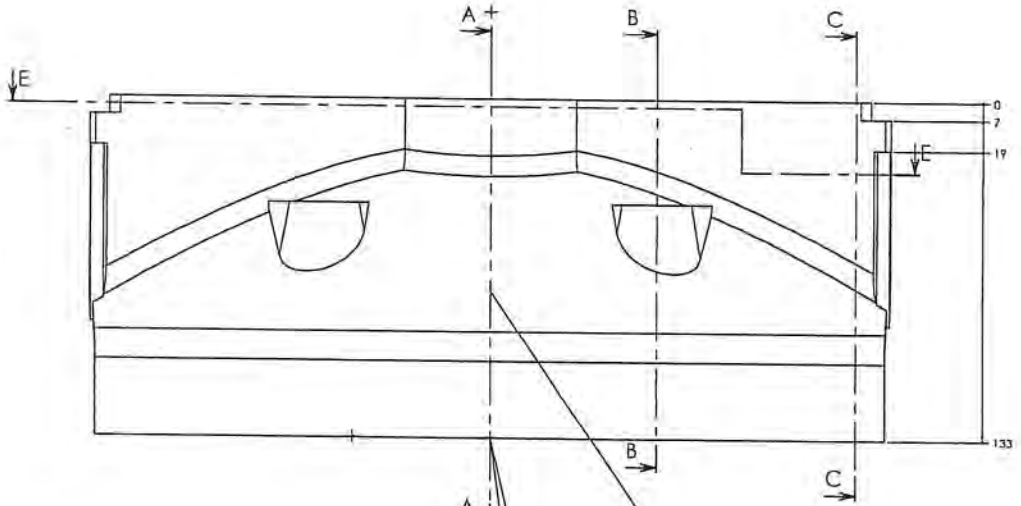
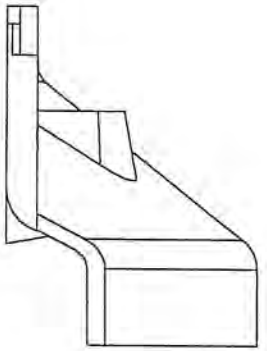
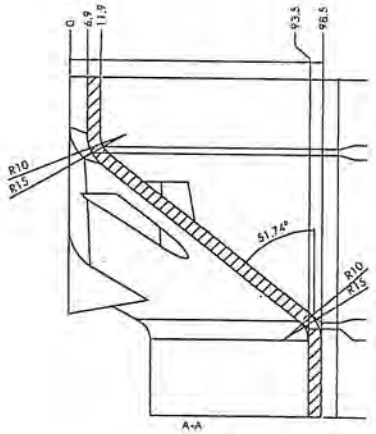


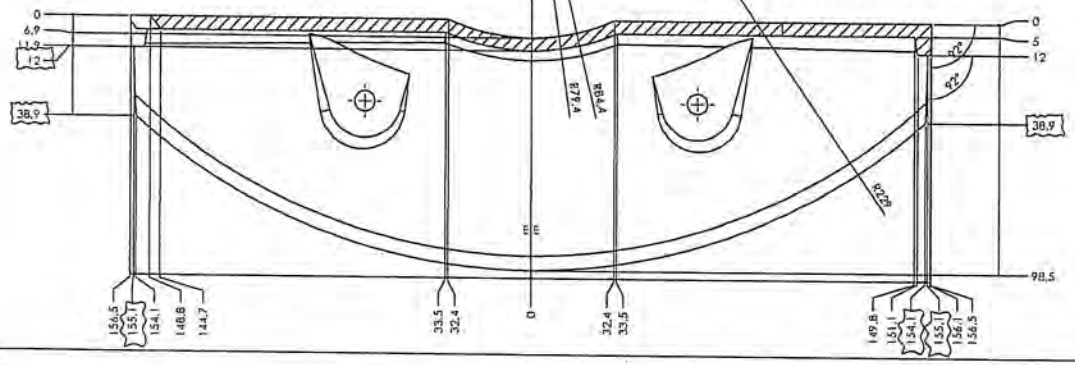


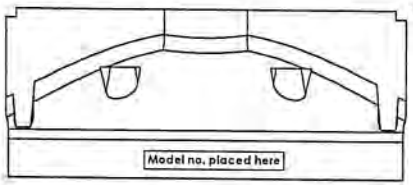










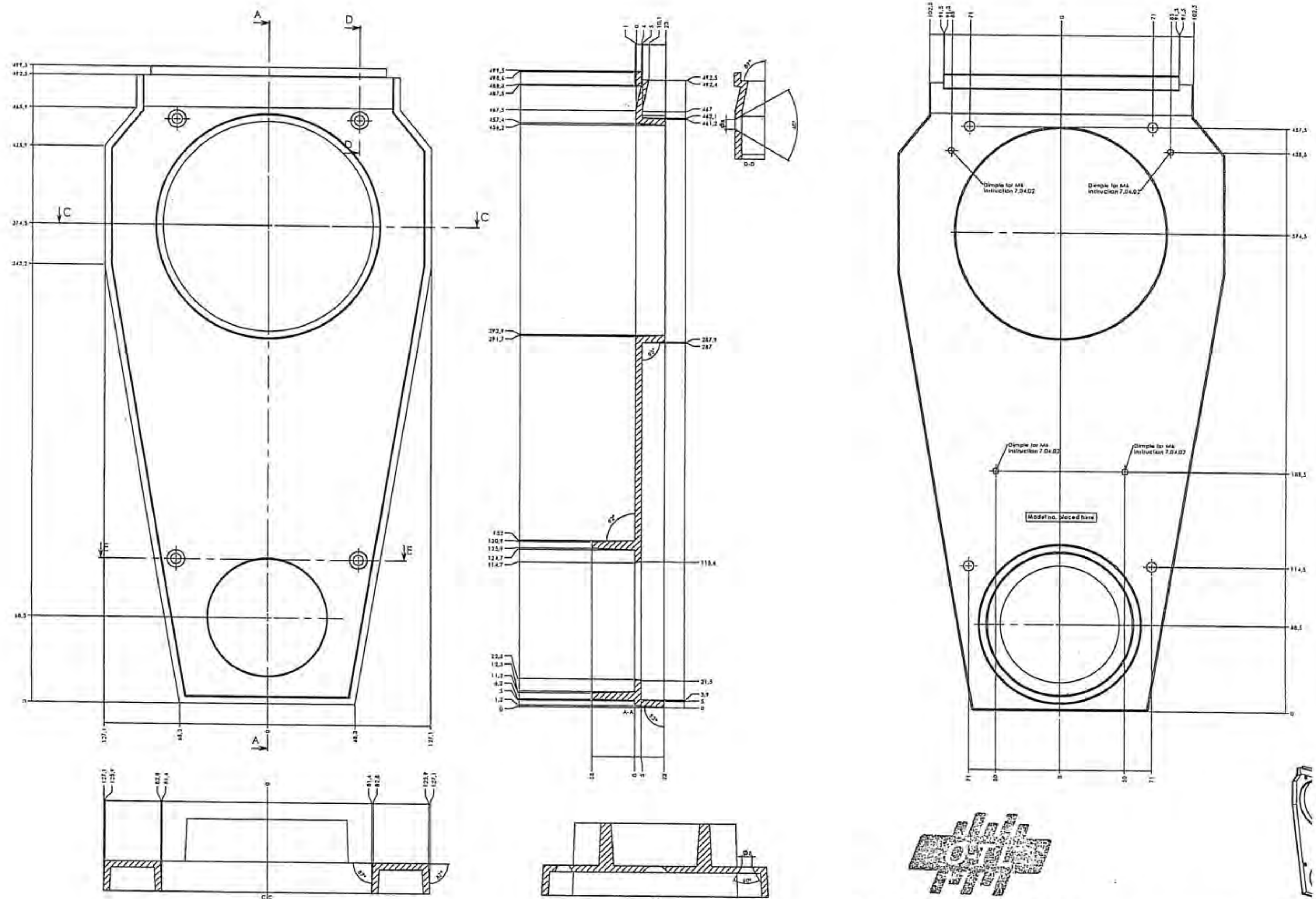


Ck'd DS Date 11/6/07

Air canal front 6100	
Luftkanal front 6100	
Morsø 6100	

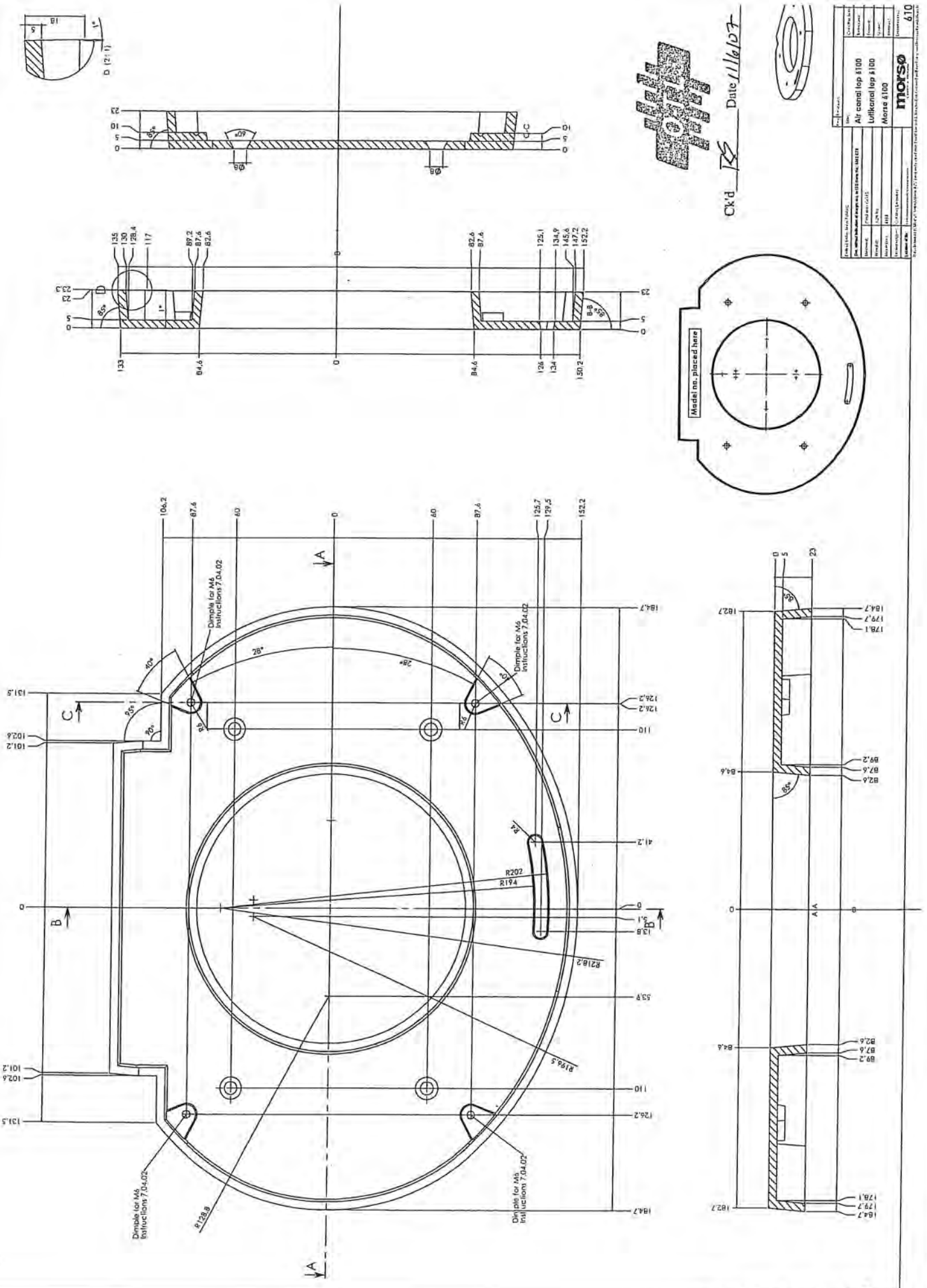
morsø

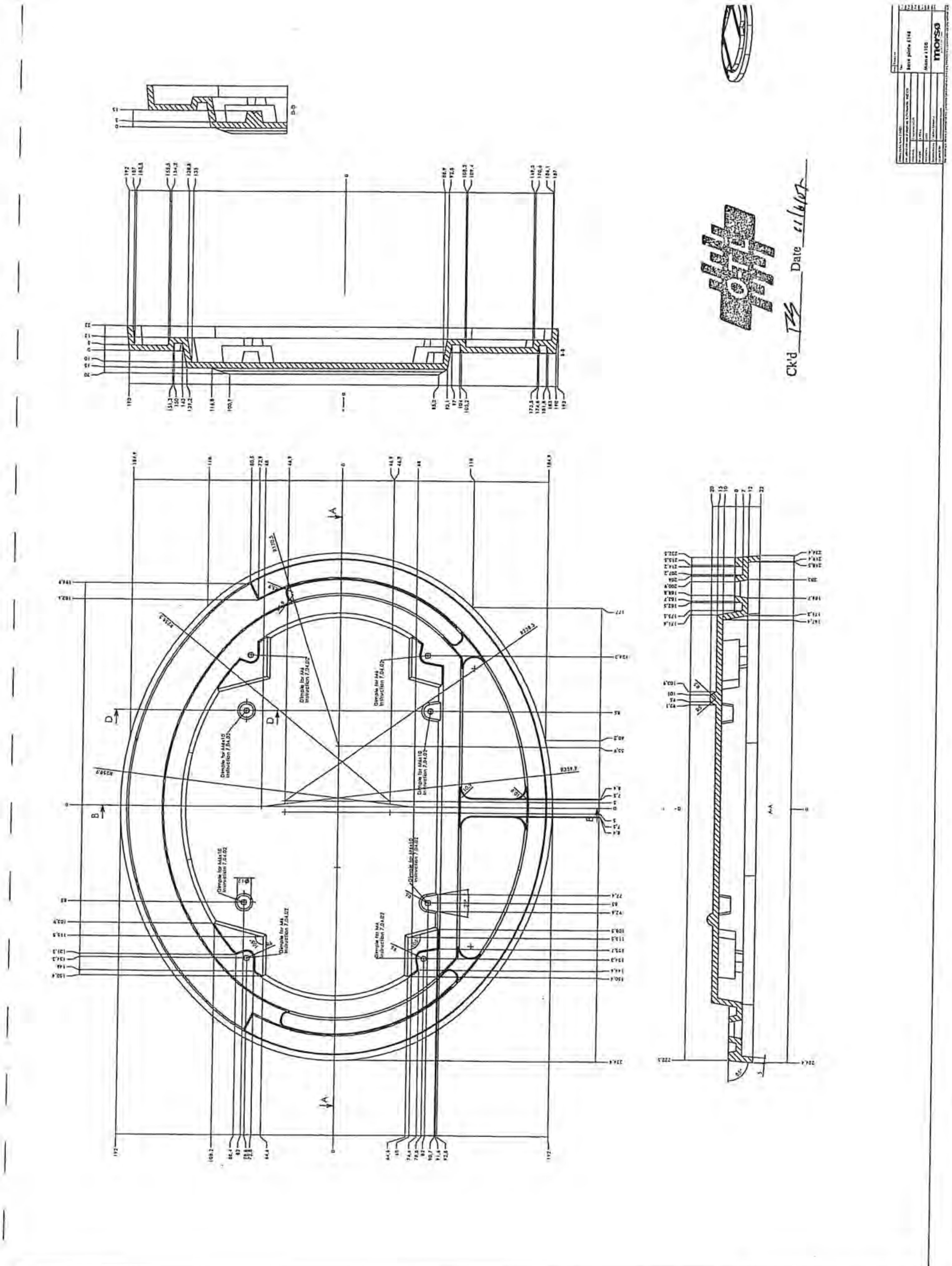
6100

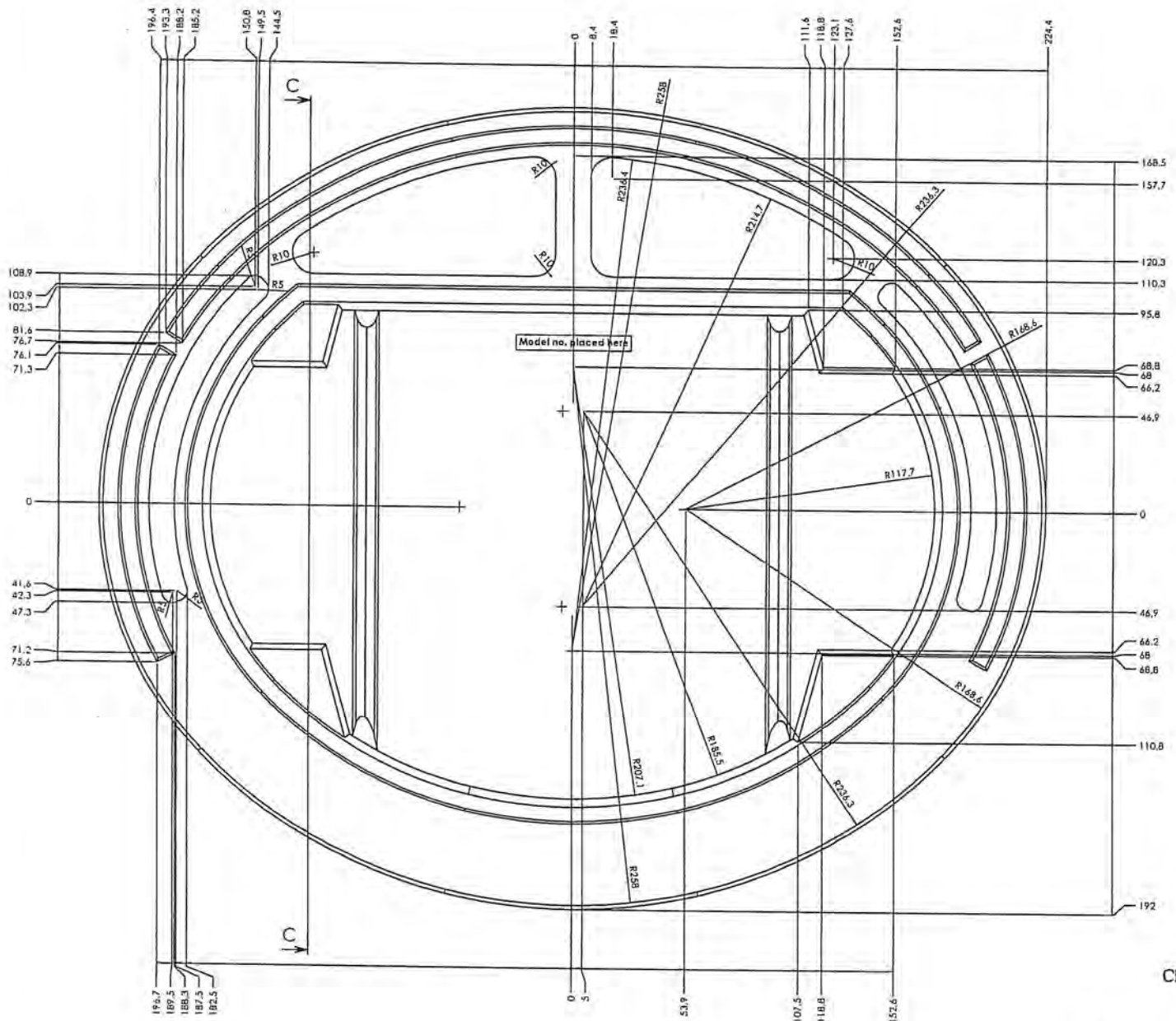


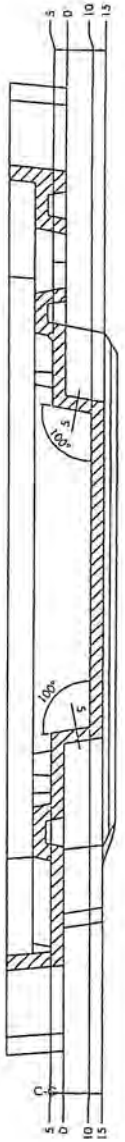
Ck'd RS Date 11/6/07

Air consol rear 6100
Luftkanal bag 6100
Morsø 6100
morsø


Ck'd
Date 11/6/07
Air canal lop 6100
Lufkanal lop 6100
Morse 6100
morsø
610
Model no. placed here
Dimple for M6 Instructions 7.04.02
R128.8
R202
R194
R218.2
R199.5


D-D
A-A
Dimple for M4x10
Instruction 7.04.02
Dimple for M6
Instruction 7.04.02
Ck'd
Date
morsø





Ck'd PS Date 11/6/07

		Base plate 6148	
		Morso 6100	morsø

610

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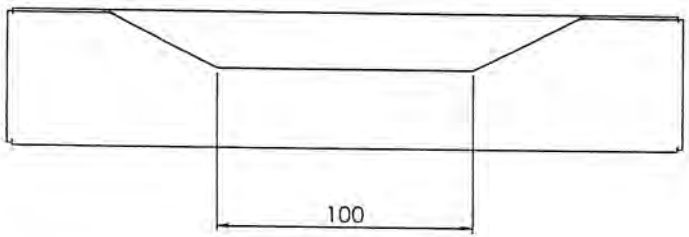
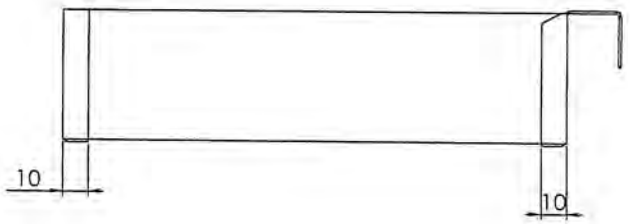
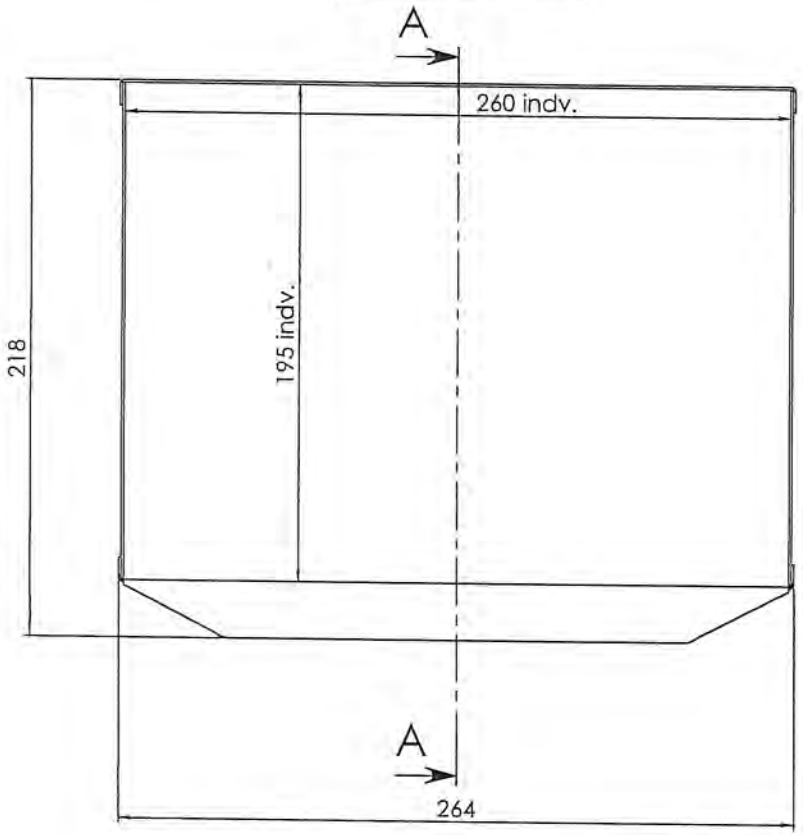
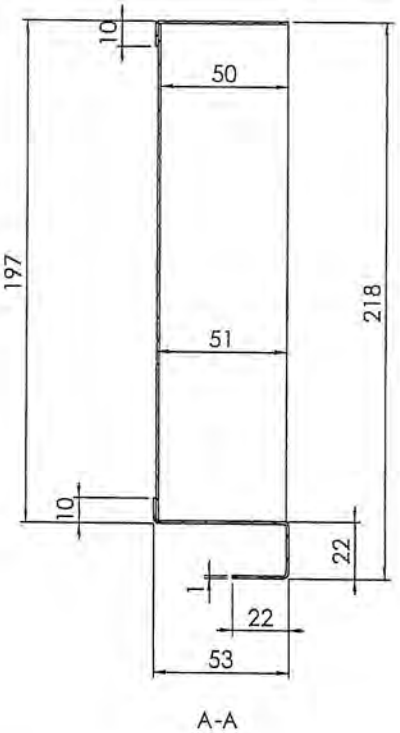


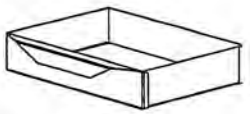






A-A

Ck'd TES Date 11/6/07



		Rev.	Revisions		Sign.:	Da
			Title:	Construction:	KDU	14.1
Dim. without indication of margin acc. to DS/ISO 2768-1 m			Ash Tray 6100	Released:	KDU	30.0
Material:	Galv. plade		Askeskuffe	Format:	A3	
Weight:	0,87 kg		Morsø 6100	Scale:	1:2	
Model no.	-			Itemno.:	7161010	
Drawingtype:	Product Drawing		morsø	Drawing no.:	6100-26 a	
Location of file:						

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Date of print: 29-10-2007

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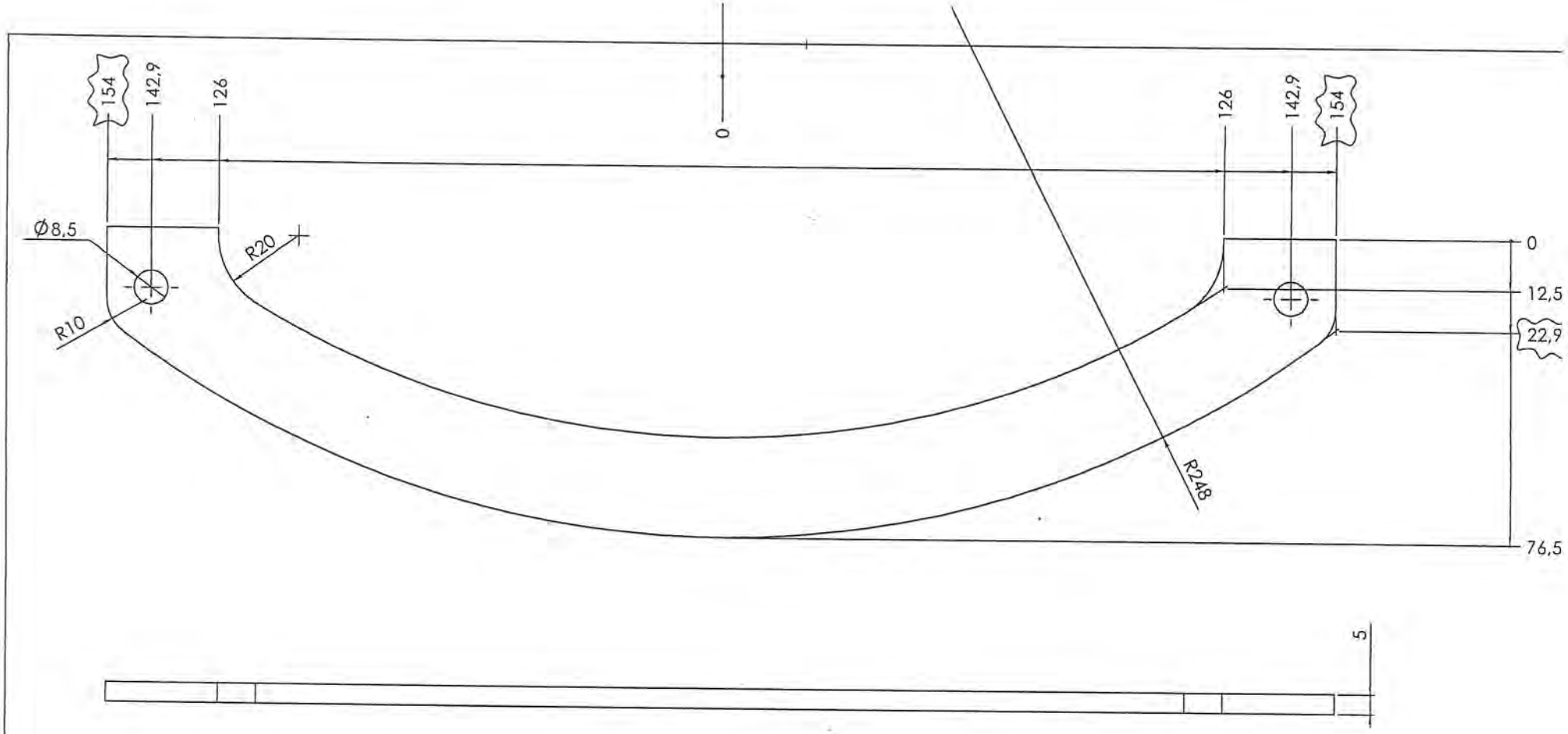

Ck'd RS Date 11/6/07

b	Taget 2mm af i bredden i begge sider.	KDU	26/
Rev.	Revisions	Sign.:	Da

Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	
Material:	Rustfri stål
Weight:	0,33 kg
Model no.	-
Drawingtype:	Emnetegning
Location of file:	

Title:
Befæst.plade røgvendepl.
Fitting plate f. baffle
Morsø 6100

morsø

Construction:	KDU 05.1
Released:	KDU 01.1
Format:	A3
Scale:	1:1
Itemno.:	716104(
Drawing no.:	6100-29 b

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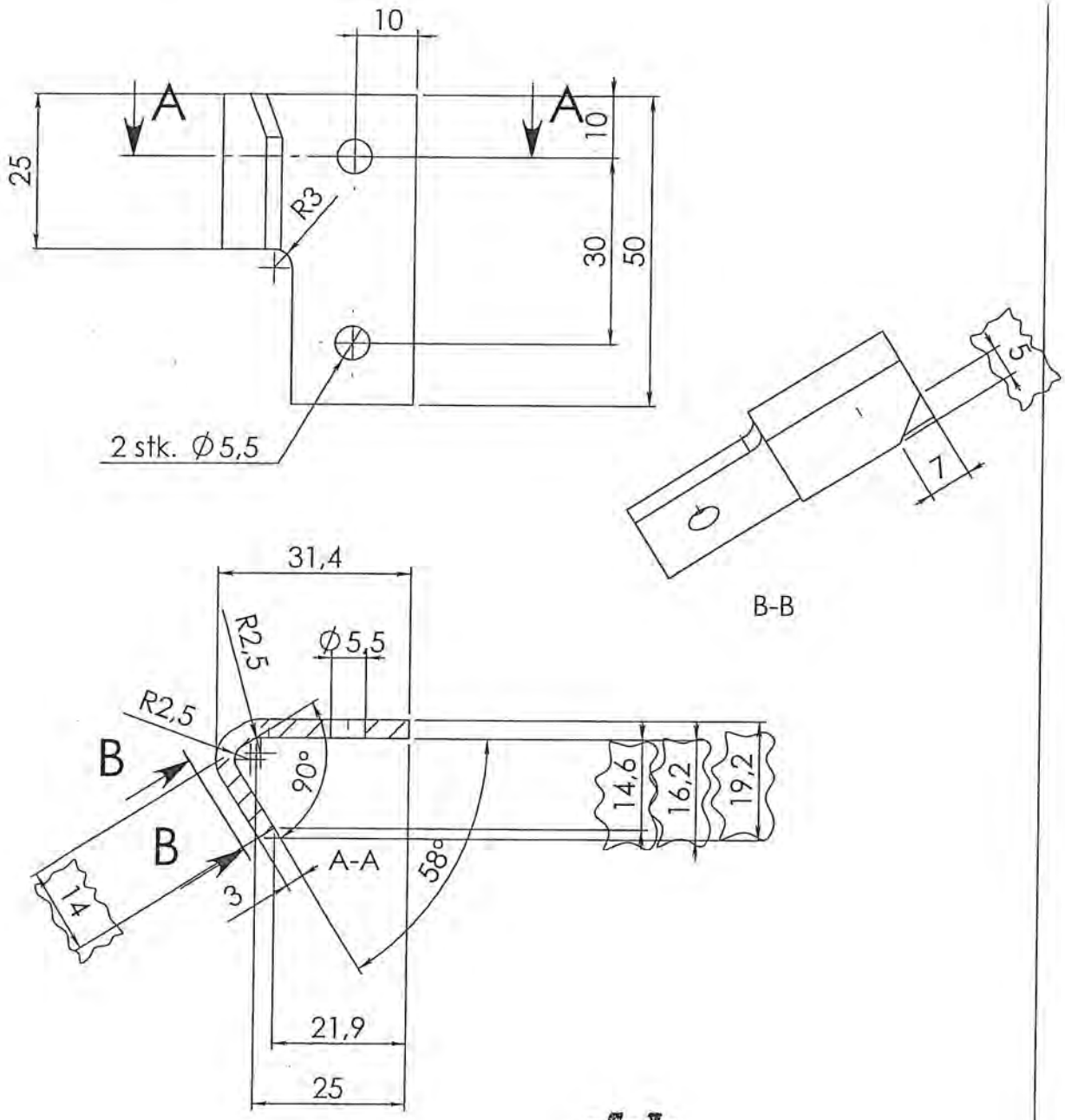
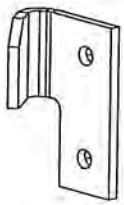


Ck'd PS Date 11/6/07



b	Lukkebeslag øget.		KDU	13.10.06
Rev.	Revisions		Sign.:	Date:
	Title:	Construction:	KDU	14.10.05
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	**Lukkebeslag 6100**	Released:	KDU	30.05.06
Material: SPD Plade	**Closing Fitting**	Format:	A4	
Weight: 0,04 kg		Scale:	1:1	
Model no. -	**Morsø 6100**	Itemno.:	71610700	
Drawingtype: Emnetegning	morsø	Drawing no.:	6100-32 b	
Location of file: U:\KDV\tegninger\6100\6100-32 Lukkebeslag.SLDPRT				

Date of print: 29-10-2007

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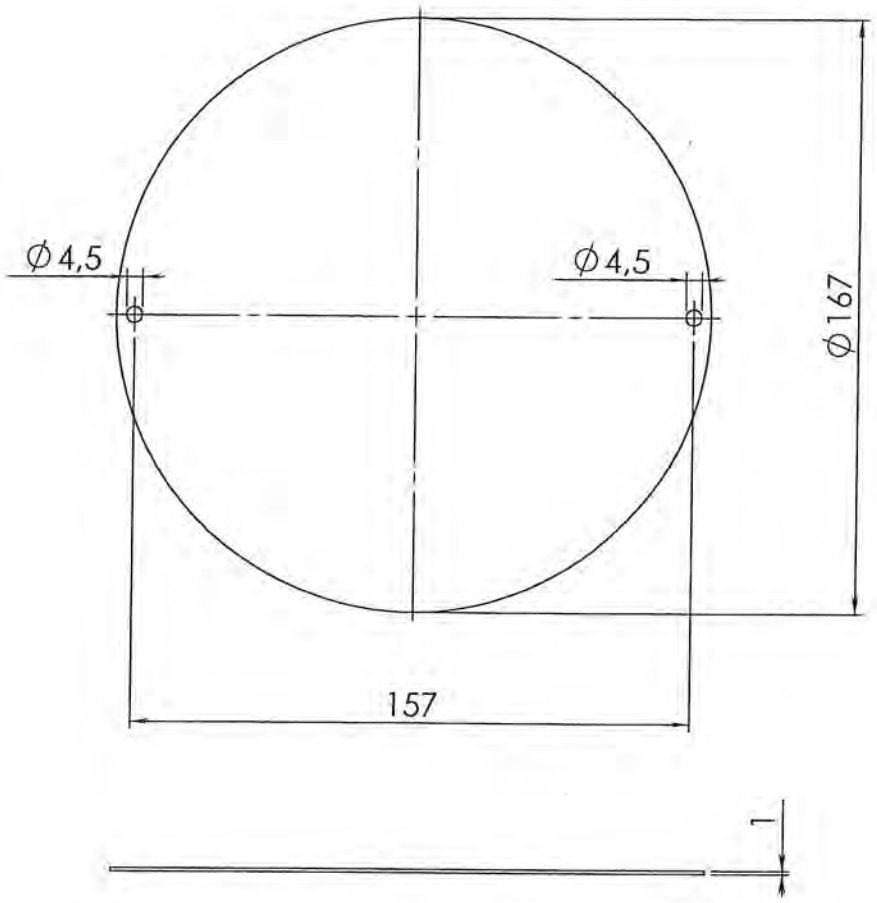

Ck'd RS Date 11/6/07

Rev.	Revisions		Sign.:	Date:
	Title:	Construction:	KDU	14.10.05
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	**Rundel 6100**	Released:	KDU	30.05.06
Material: SPD Plade	**Round plate**	Format:	A4	
Weight: 0,17 kg		Scale:	1:2	
Model no. -	**Morsø 6100**	Itemno.:	71611000	
Drawingtype: Emnetegning	morsø	Drawing no.:	6100-36 a	
Location of file: U:\UDV\Tegninger\6100\6100-36 Rundel.SLDPRT				

Date of print: 29-10-2007

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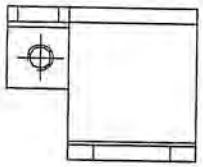
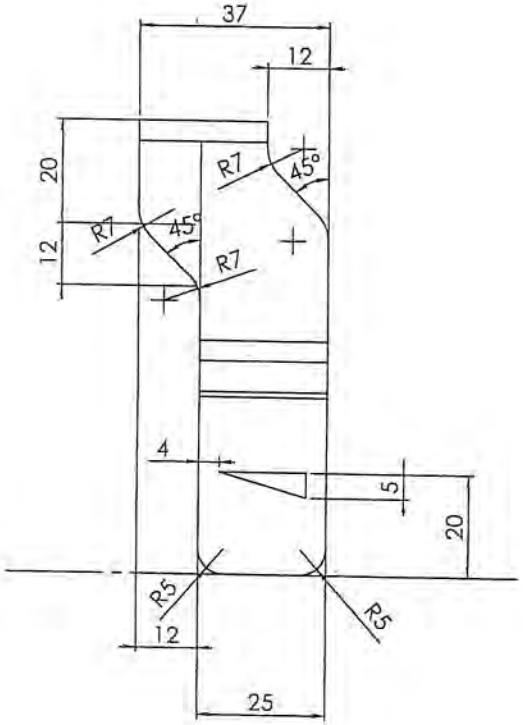
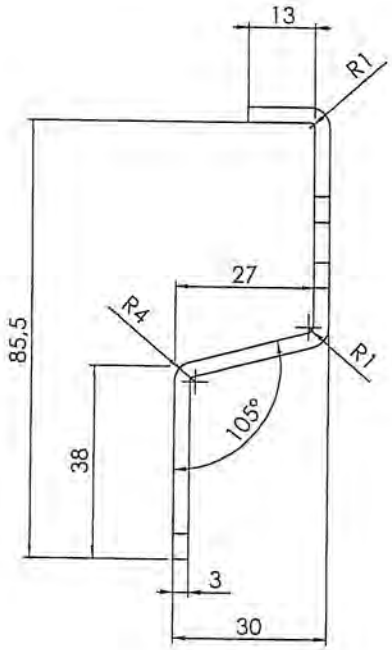
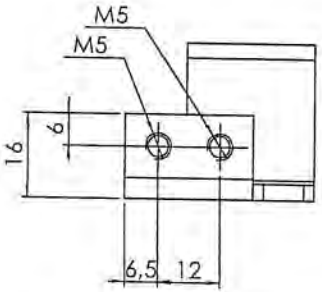






Ck'd PS Date 11/6/07



Ingen grater på kanterne.		Rev.	Revisions	Sign.:	D
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m		Title:		Construction:	KDU 14.
Material:	Rustfri stål (Børstet)	Greb sek. spjæld 6100		Released:	KDU 30.
Weight:	0,07 kg	Handle primary air NA		Format:	A3
Model no.	-	Morsø 6100		Scale:	1:1
Drawingtype:	Emnetegning	morsø		Itemno.:	716112
Location of file:				Drawing no.:	6100-38 a

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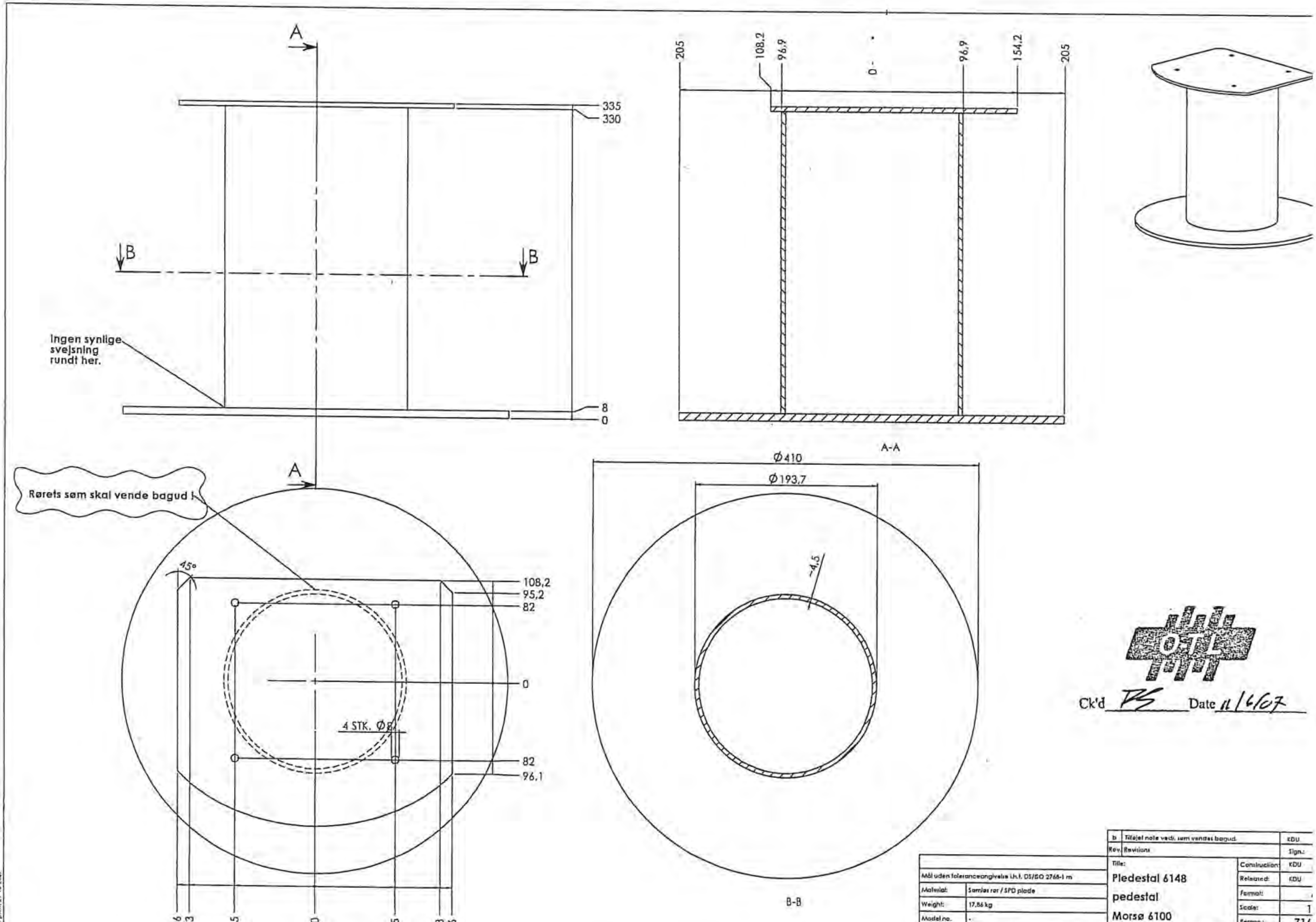

Mål uden toleranceangivelse iht. DS/ISO 2768-1 m	
Material:	Sømløs rør / SPD plade
Weight:	17,86 kg
Model no.	-
Drawingtype:	Emnetegning
Location of file:	

b	Tilføjet note vedr. søm vendes bagud.		KDU
Rev.	Revisions		Sign.:
Title:		Construction:	KDU
Piedestal 6148		Released:	KDU
pedestal		Format:	
Morsø 6100		Scale:	1
		Itemno.:	716
morsø		Drawing no.:	6100-4

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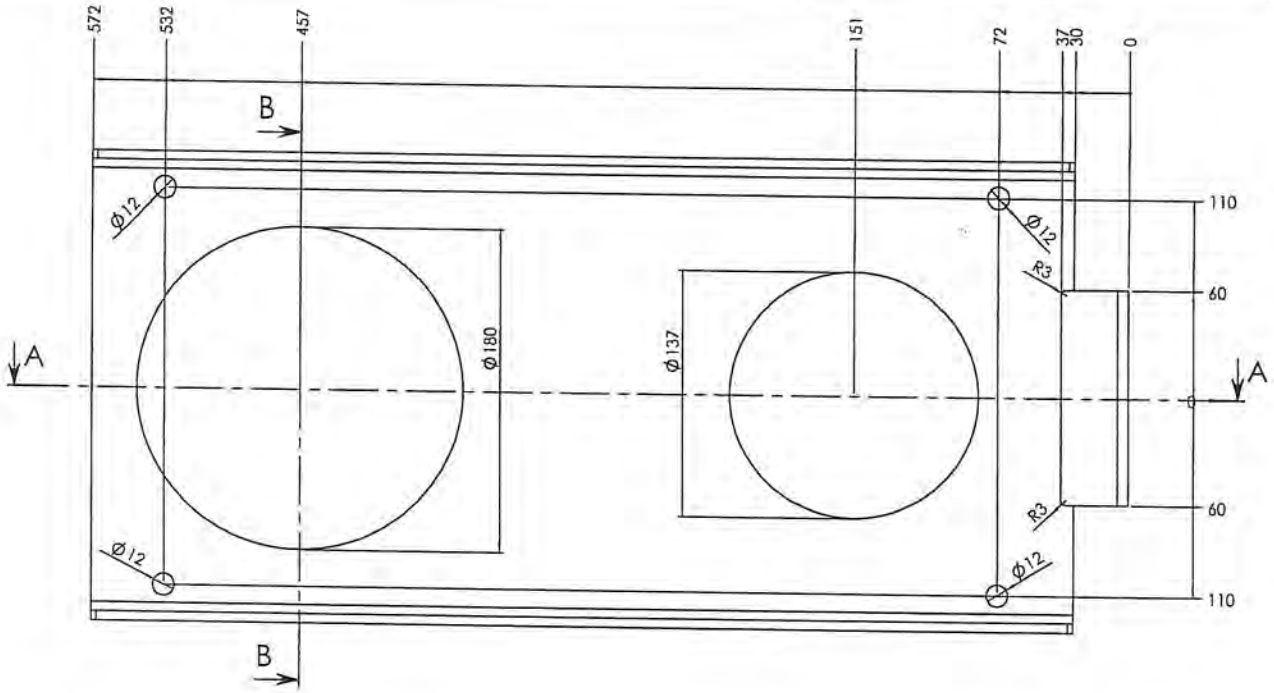
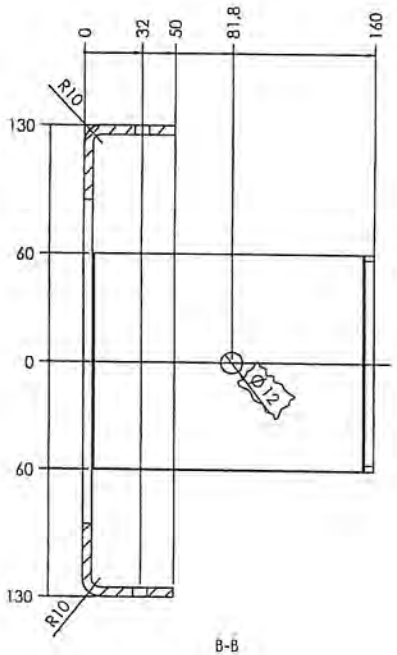
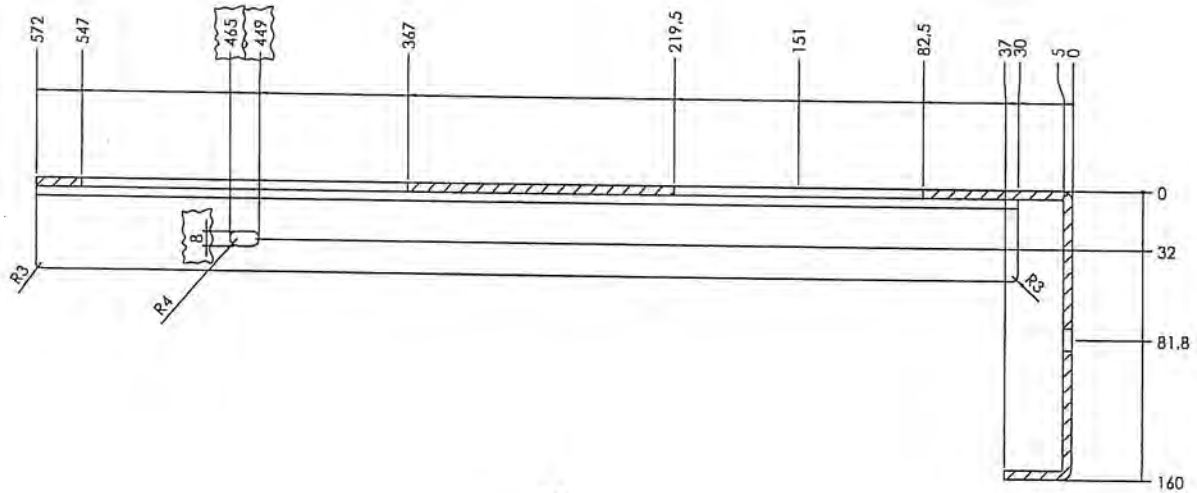
Date of plot: 29-10-2007



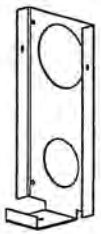


B-B



A-A

Ck'd PS Date 11/6/07



		b	Hullet i sider og bund øget p.g.a. justeringsmulighed
		Rev.	Revisions
Mål uden tolerancesangivelse i h.t. DS/ISO 2768-1 m		Title:	Vægbeslag 6170 Wall fitting Morsø 6100
Material:	SPD Plade	Construction:	KDU
Weight:	4,71 kg	Released:	KDU
Model no.	-	Format:	
Drawingtype:	Product Drawing	Scale:	
Location of file:		Itemno.:	716
		Drawing no.:	6100-5

KDU
Sign.:

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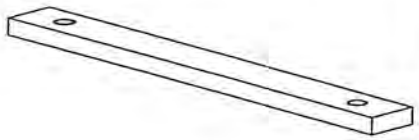
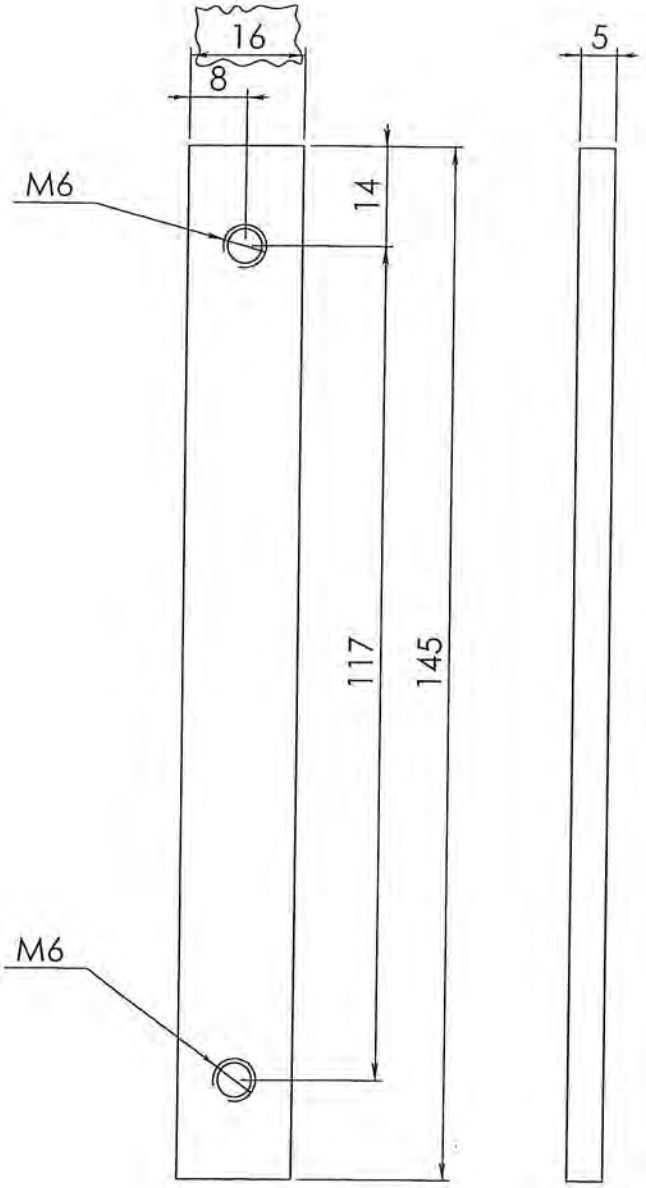
Date of print: 29-10-2007



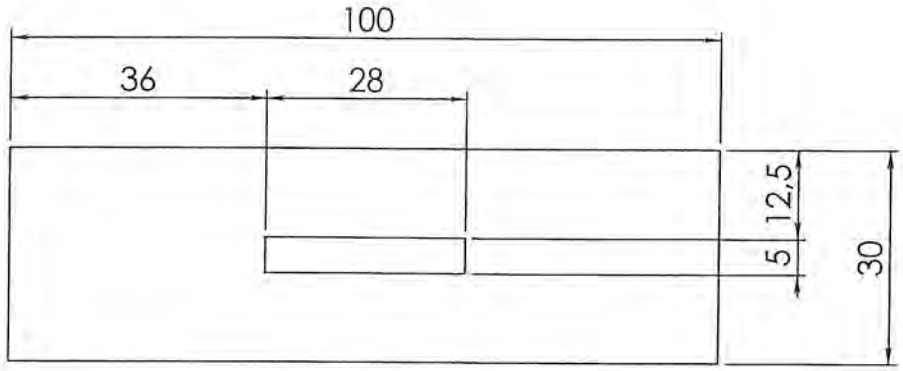


Ck'd PS Date 11/6/07

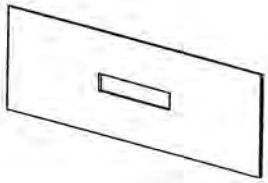
Rev.	Revisions		Sign.:	Date:
a	Bredde ændret fra 15mm til 16mm efter lev.ønske.		KDU	13.09.06
	Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	Title: Kuglespærre Ø133,5 røgtud Stop bar Morsø 6100	Construction:	KDU 21.08.06
			Released:	KDU 13.09.06
	Material: Båndstål sort, varmt valset		Format:	A4
	Weight: 0,09 kg		Scale:	1:1
	Model no. -		Itemno.:	71611900
	Drawingtype: Emnetegning	morsø	Drawing no.:	6100-64 a
	Location of file: U:\UDV\Tegninger\6100\6100-64 Kuglespærre ø133,5 røgtud.SLDPRT			

Date of print: 29-10-2007

This drawing is Morsø Jernstøberi A/S' property and must not be sold, lended or copied without any written authorization from the company.



Ck'd DS Date 11/6/07

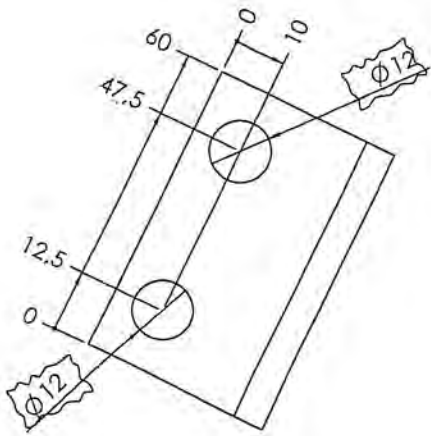


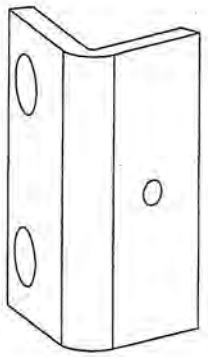
Rev.	Revisions	Sign.:	Date:

Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	Title: Lukkepl. sek. spjæld Closing pl. f. primary NA Morsø 6100	Construction:	KDU	14.10.05
		Released:	KDU	30.05.06
Material: SPD Plade		Format:	A4	
Weight: 0,02 kg		Scale:	1:1	
Model no. -		Itemno.:	71610800	
Drawingtype: Emnetegning	morsø	Drawing no.:	6100-33 a	
Location of file: u:\uov\tegninger\6100\6100-33 [Lukkepl. sek. spjæld.SLDPRT				

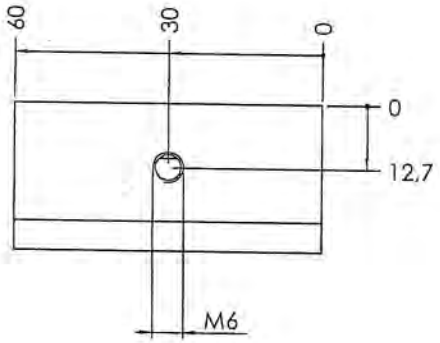
Date of print: 29-10-2007

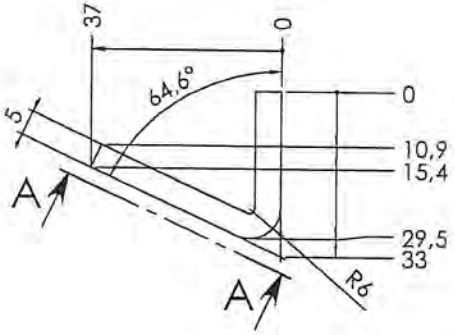
This drawing is Morsø Jernstøberi A/S' property and must not be sold, lended or copied without any written authorization from the company.





A-A





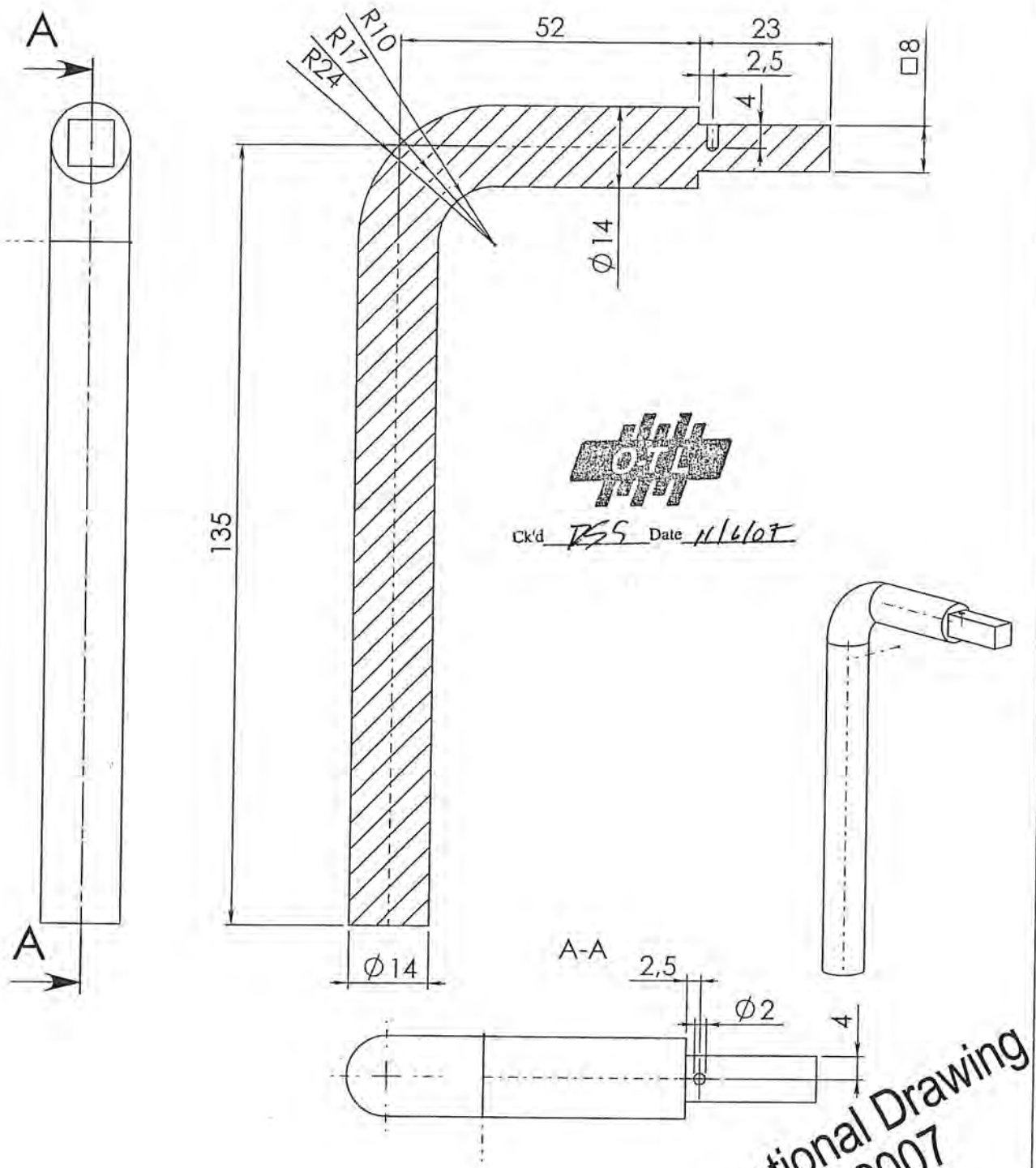
Ck'd PS Date 11/6/07

c	Huller øget fra ø8,5mm til ø12mm.		KDU	19.
b	Huller flyttet længere ind samt hulstørrelse øget.		25.05.07	K
Rev.	Revisions		Sign.:	Da

Dim. without indication of margin acc. to DS/ISO 2768-1 m		Title: Fæstebeslag vægbeslag Fitting f. wall fitting 6170 Morsø 6100	Construction: KDU 19.0
Material:	SPD Plade		Released: KDU 10.0
Weight:	0,14 kg		Format: A3
Model no.			Scale: 1:1
Drawingtype:	Product Drawing		Itemno.: 716121C
Location of file:		morsø	Drawing no.: 6100-71 c

This drawing is Morsø Jernstøberi A/S' property and must not be sold, lended or copied without any written authorization from the company

Date of print: 29-10-2007



Constructional Drawing
25.10.2007

Rev.	Revisions	Sign.:	Date:

Overfladebehandling: Silkeslebet	Title:	Construction:	KDU	27.08.07
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	**Håndtag løst 6100 NA**	Released:		
Material: Rustfri stål	**Handle**	Format:	A4	
Weight: 0,23 kg		Scale:	1:1	
Model no. -	**Morsø 6100**	Itemno.:	75610061	
Drawingtype: Emnetegning	morsø	Drawing no.:	6100-77	
Location of file:				

Date of print: 29-10-2007

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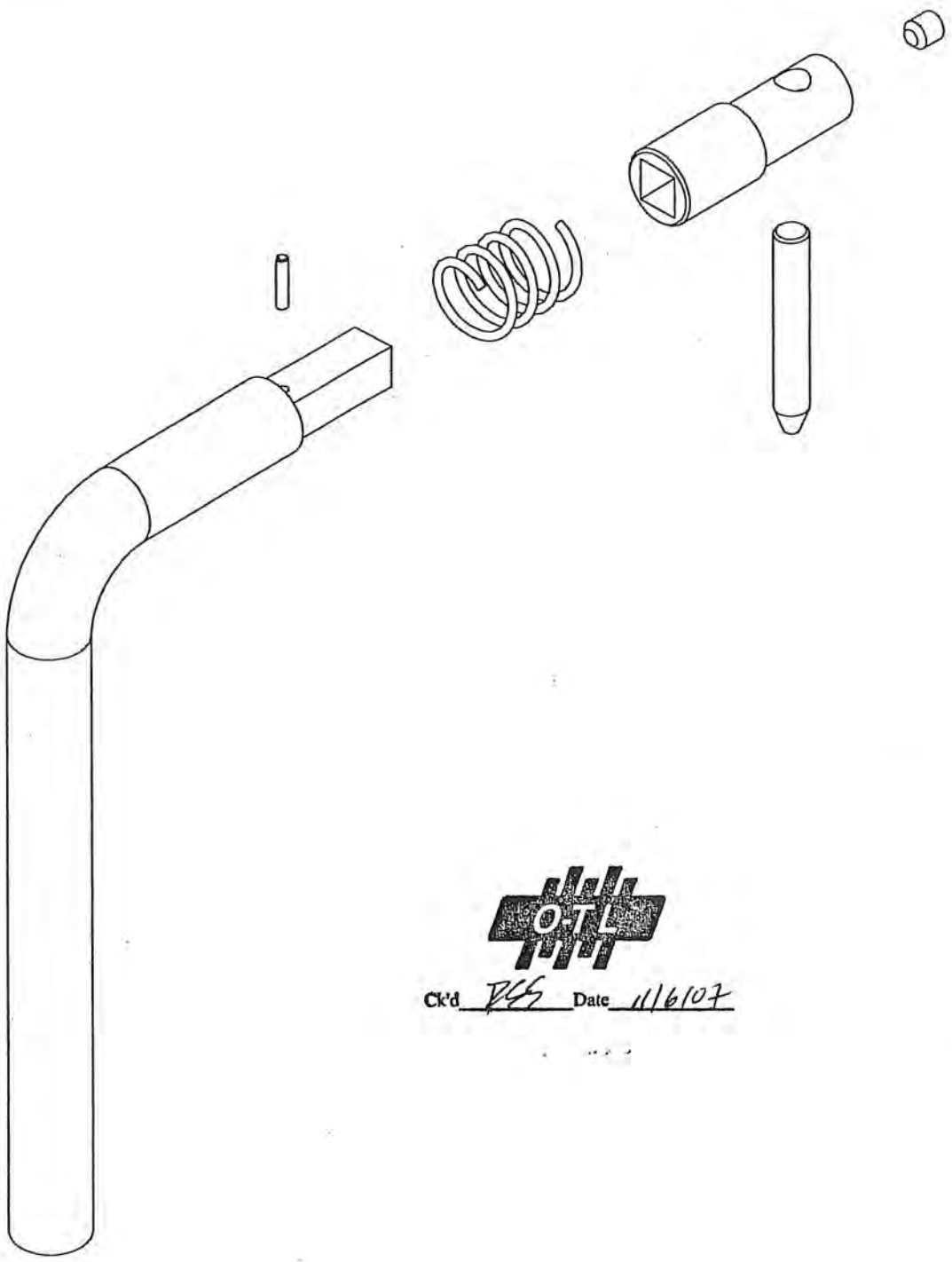


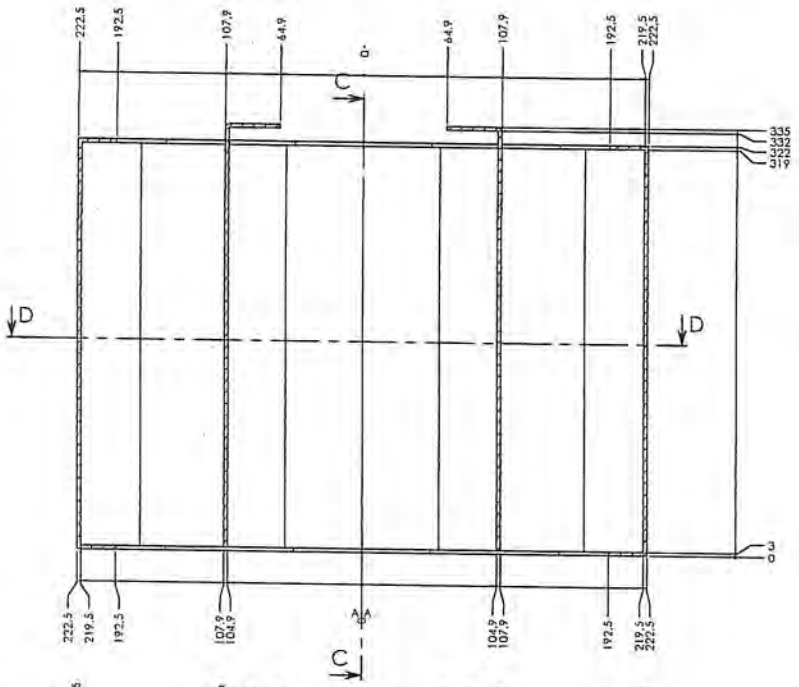
Ck'd PES Date 11/6/07

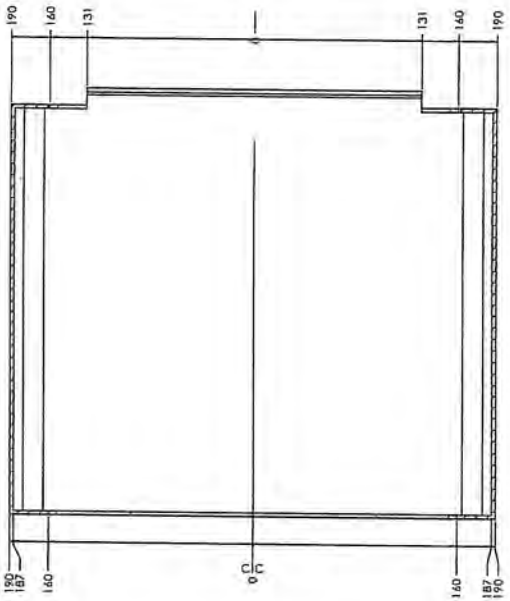
Rev.	Revisions	Sign.:	Date:

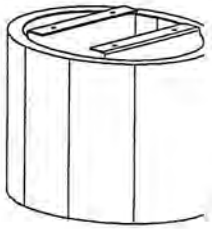
	Title:	Construction:	RSV	31.10.07
	Exploded Diagram	Released:		
Material:	**Handle**	Format:	A4	
Weight: 0,34 kg	**Morsø 6100 NA**	Scale:	1:1	
Model no.		Itemno.:		
Drawingtype:	morsø	Drawing no.:		
Location of file:				

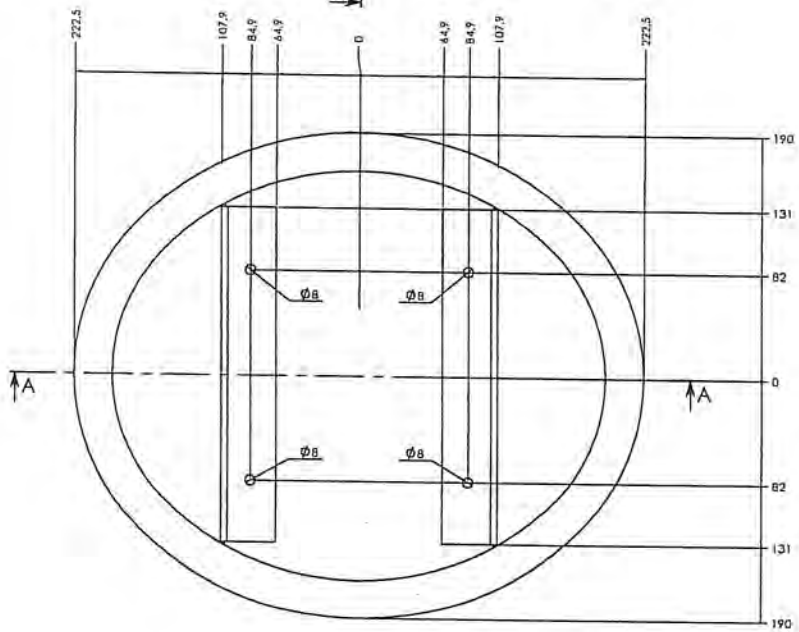
Date of print: 31-10-2007

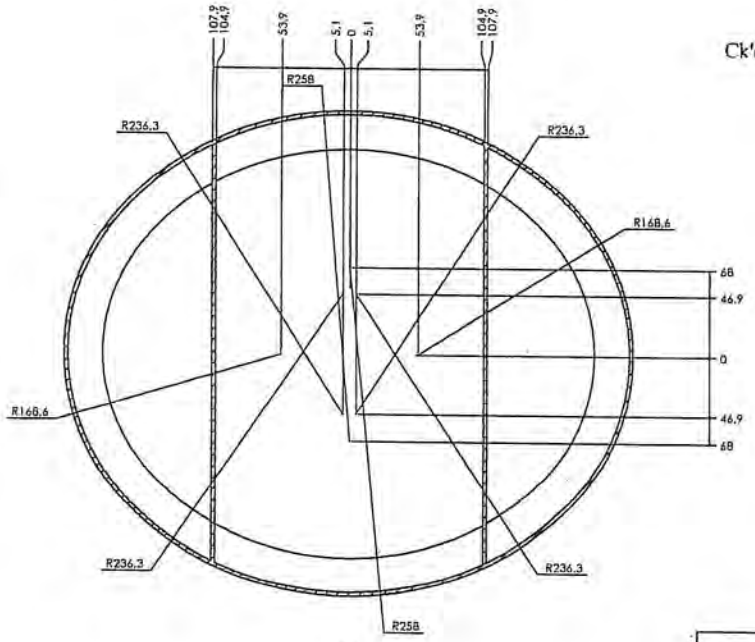
This drawing is Morsø Jernstøberi A/S' property and must not be sold, lended or copied without any written authorization from the company.









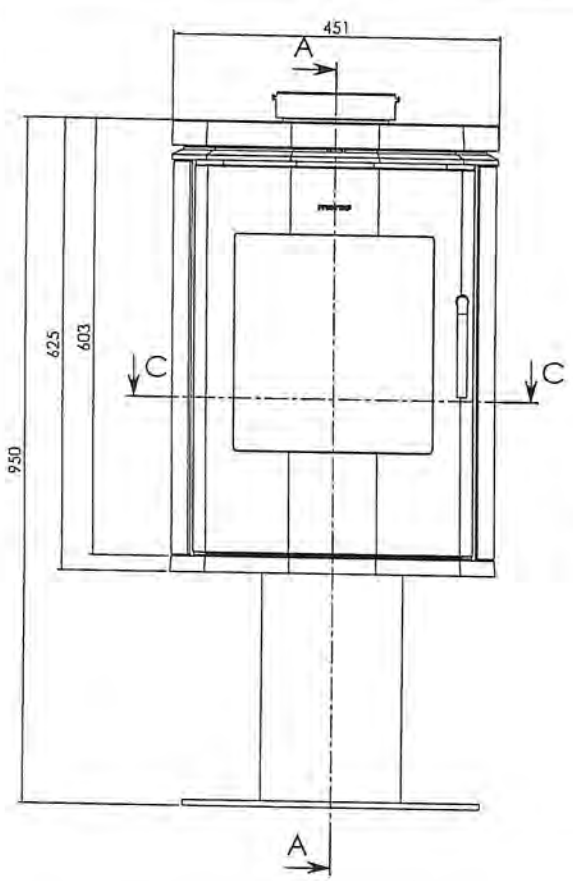


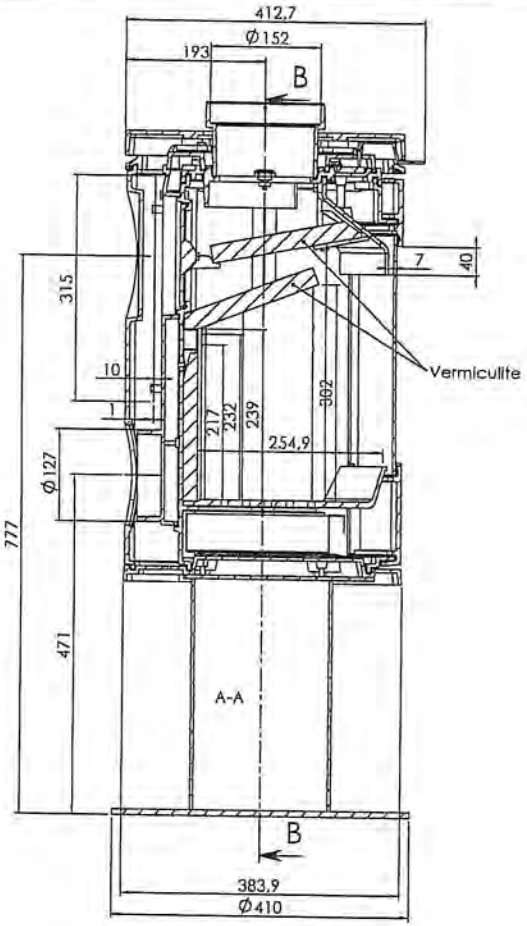
Ck'd PS Date 11/6/07

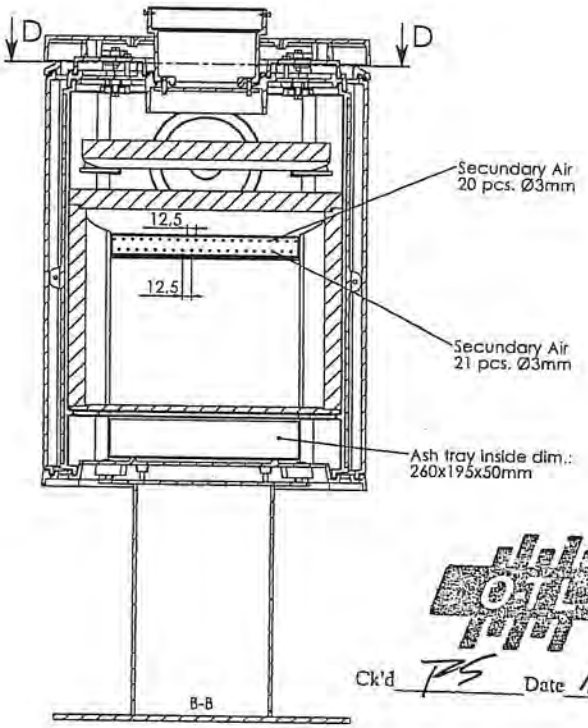
Constructional Drawin
31.10.2007

		Pladejernssokkel 6143	Construction
			Assembly
			Drawn
		Morsø 6100	Tracer
			Revision
		morsø	Drawing No. 61

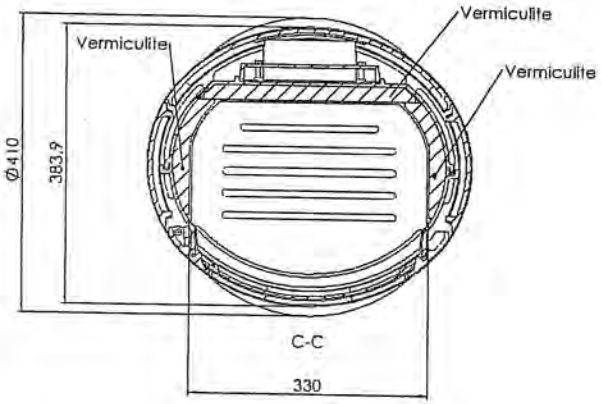
1-70 OF 1-83

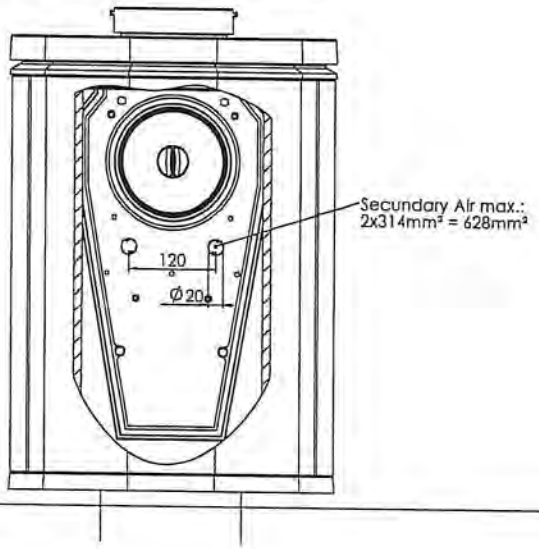


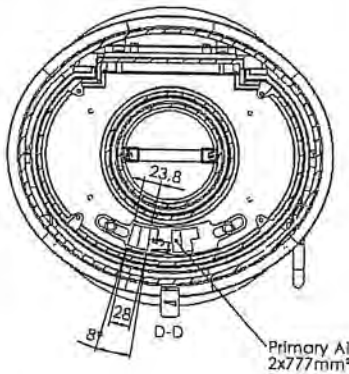


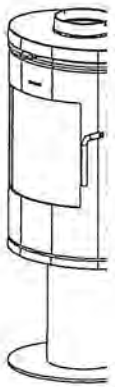


Ck'd PS Date 11/6/6









Dim. without indication of margin acc. to DS/ISO 2768-1 m		Title: Approval Drawing Morsø 6148 NA	Construction: RSV
Material:			Released:
Weight:	-		Format:
Model no.:			Scale:
Drawingtype:	Approval Drawing		Remns.:
Location of file:		morsø	Drawing no.: 6100-8

Rev. Revisions Sign.:

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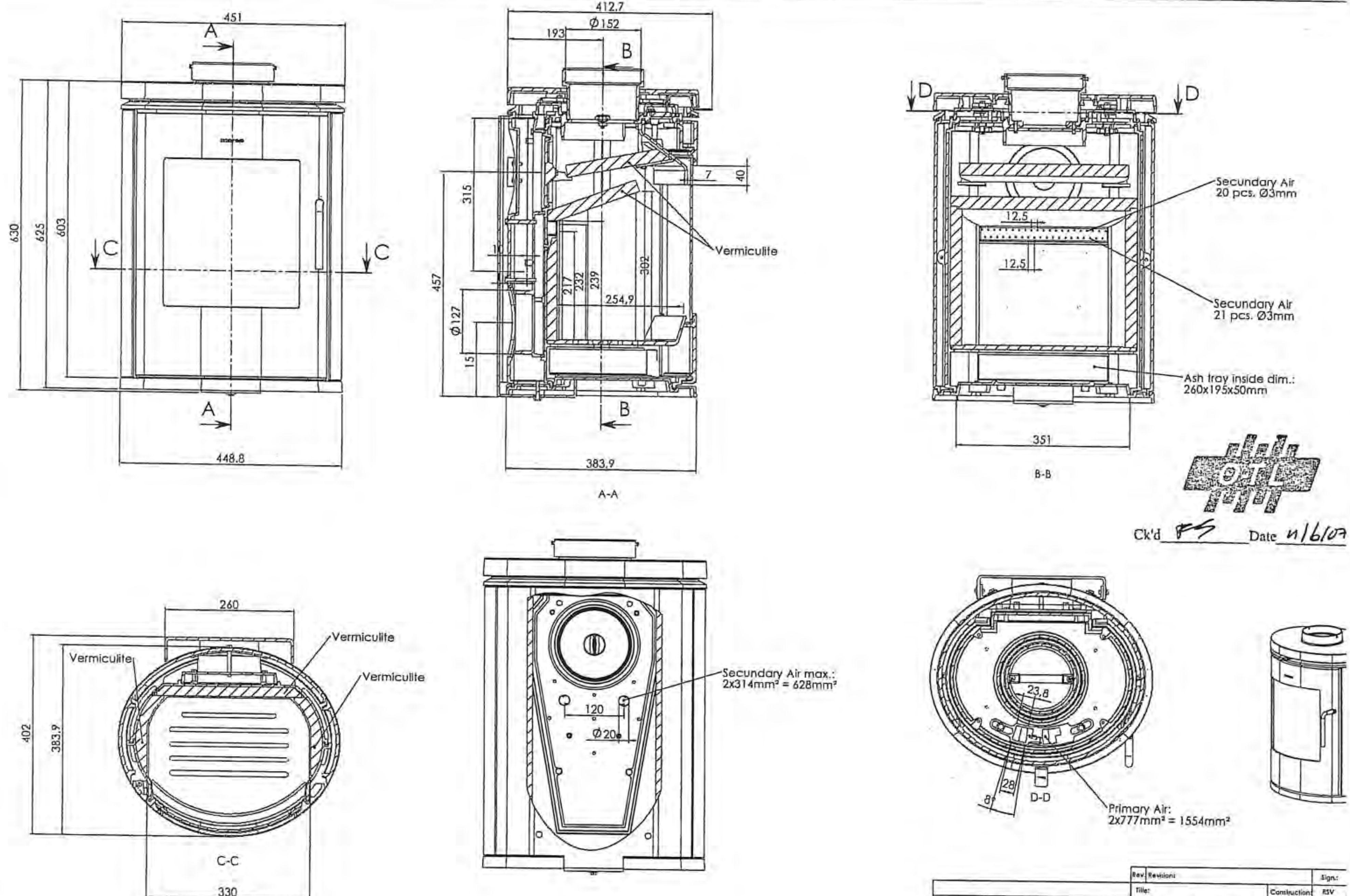
Date of print: 28-05-2007



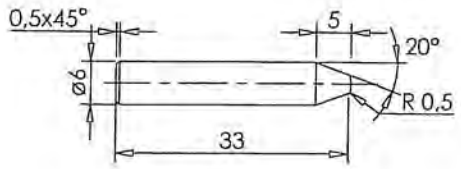
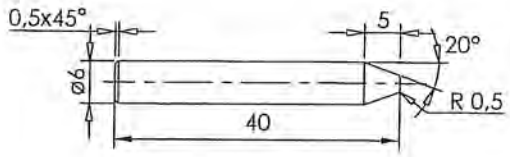
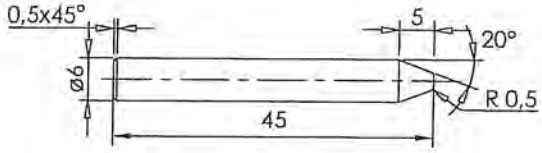
Ck'd FS Date 11/6/07

Dim. without indication of margin acc. to DS/ISO 2768-1 m	
Material:	
Weight:	
Model no.	
Drawingtype:	Approval Drawing
Location of file:	

Rev.	Revisions:		Sign.:
Title:	Approval Drawing Morsø 6170 NA	Construction:	RSV
		Released:	
		Format:	
		Scale:	
		Remna.:	
morsø		Drawing no.:	6100-8…

This drawing is Morsø Jernstøberi A/S' property and must not be sold, lended or copied without any written authorization from the co…

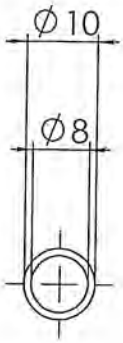
Date of print: 30-10-2007

	Anvendes til:
EDB nr. 541403  	1410
EDB nr. 542056  	1B 2B 1126
EDB nr. 541082  	1610 1710

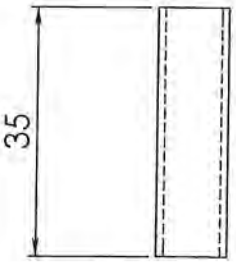
Mart.: ø6 Rf. automatstål
EDB nr. 714005

Ck'd PG Date 11/6/97

Titel:	Sign.:	Dato:	Revision	Sign.	Dato
Ø6 hængselstifter	N.Aa.	06.10.87	Gamdrup TegneTeknik	HCH	April 96
	Tegn.form.: A4	Målforhold 1:1	Tilføjet grader	KDU	20.12.96
Tegningsnummer: 1126-38-4	Varenummer: se teg.				
morsø By appointment to the Royal Danish Court	Filnavn: 1126-38				



Ck'd FS Date 11/4/07



		Rev.	Revisions		Sign.:	Date:
		Title:		Construction:	RSV	21.11.03
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m		**Afstandsrør ø10x1 L=35**		Released:		
Material:	galv.hydraulikrør	**ø10x1 L=35**		Format:	A4	
Weight:	0,01 kg			Scale:	1:1	
Model no.	-	**Morsø 1126**		Itemno.:	542641	
Drawingtype:	Emnetegning	morsø		Drawing no.:	1126-71 a	
Location of file:	U:\udv\Tegninger\standardbibliotek\Afstandsrør\Afstandsrør ø10x1.SLDPRT					

Date of print: 30-10-2007

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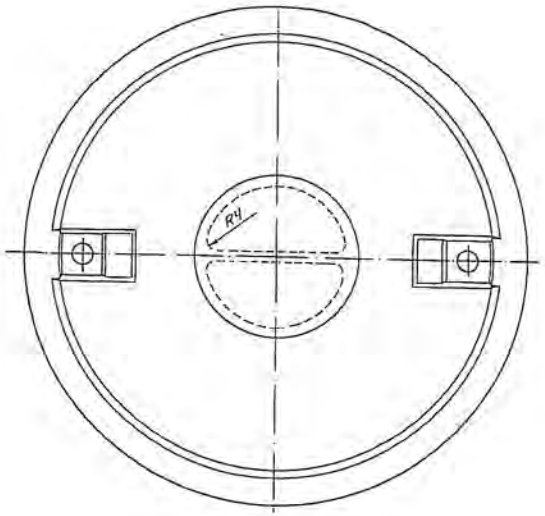
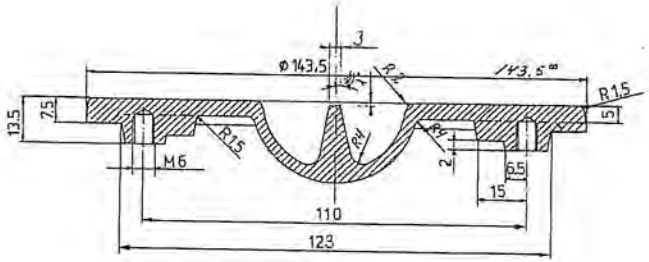
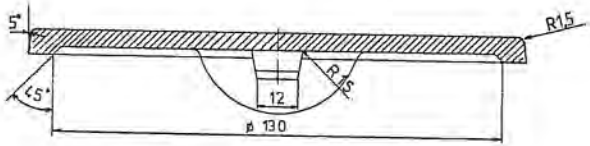


Slip 10° hvor ikke andet er vist

Ikke viste rundinger R1

Ck'd PS Date 11/6/07



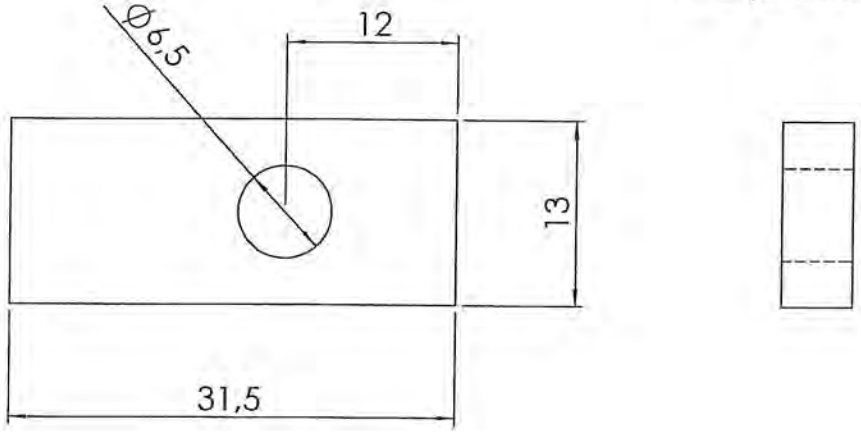


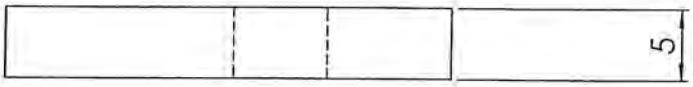
Dæksel/varmeplade Morsø 1400 Universalovn	Varenr. 341440	319-91 P.MU.	
		1:1	5-3-84 T.T. Model Nr. 1410
		Ændret 2-12-92 TT	
		1400-10-2	
		Vægt. 0,80 kg	

A B C D E F G H J K L M

1 - 75 OF 1 - 83

Ck'd PS Date 11/6/07





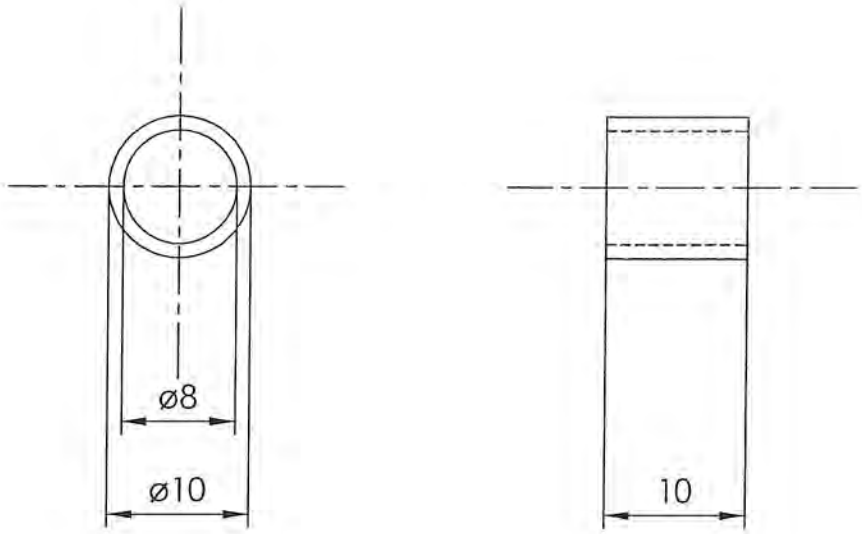
Rev.	Revisionstekst:	Sign.:	Dato:

Materiale:	Sort fladjern	Titel:	Konstr.:	RSV	03.03.2000
Vægt:	0,015 kg. Bearbejdes:	**Lus uden gevind**	Frigivet:		
Overfladebeh.:	m²		Tegn.format:	A4	
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m		Målforhold:	**2:1**	
Ruhedstolerance:		**Morsø 1400**	Varenr.:	**44256800**	
Værktøjsnr.:		morsø	Tegningsnr.:	**1400-199**	
Tegningstype:	Emnetegning				

1400-199 lus uden gevind - Sheet1

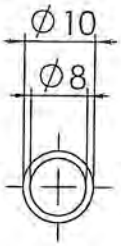
Denne tegning tilhører Morsø Jernstøberi A/S og må ikke afhændes, udlånes eller kopieres uden firmaets skriftlige tilladelse

Ck'd PS Date 11/6/07

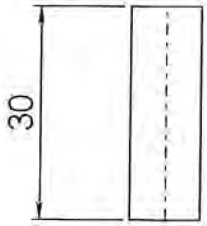


Matr:10x1 Hydraulikrør galv. varenr.712602

Titel: Afstandsrør ø10x1 L=10	Sign.: RS	Dato: 970113	Revision	Sign.	Dato
	Tegn.form.: A4	Målforhold 2:1			
Tegningsnummer: 1400-300-4	Varenummer: 541439				
morso / Jernstøberi A/S	Filnavn: 1400-300				



Ck'd PS Date 11/6/07



Rev.	Revisions	Sign.:	Date:

Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	Title: **Afstandsrør ø10x1 L=30**	Construction:	RSV	04.05.06
		Released:		
Material: galv.hydraulikrør		Format:	A4	
Weight: 0,01 kg		Scale:	1:1	
Model no. -		Itemno.:	541440	
Drawingtype: Emnetegning	morsø	Drawing no.:	1400-315 a	
Location of file:				

Date of print: 30-10-2007

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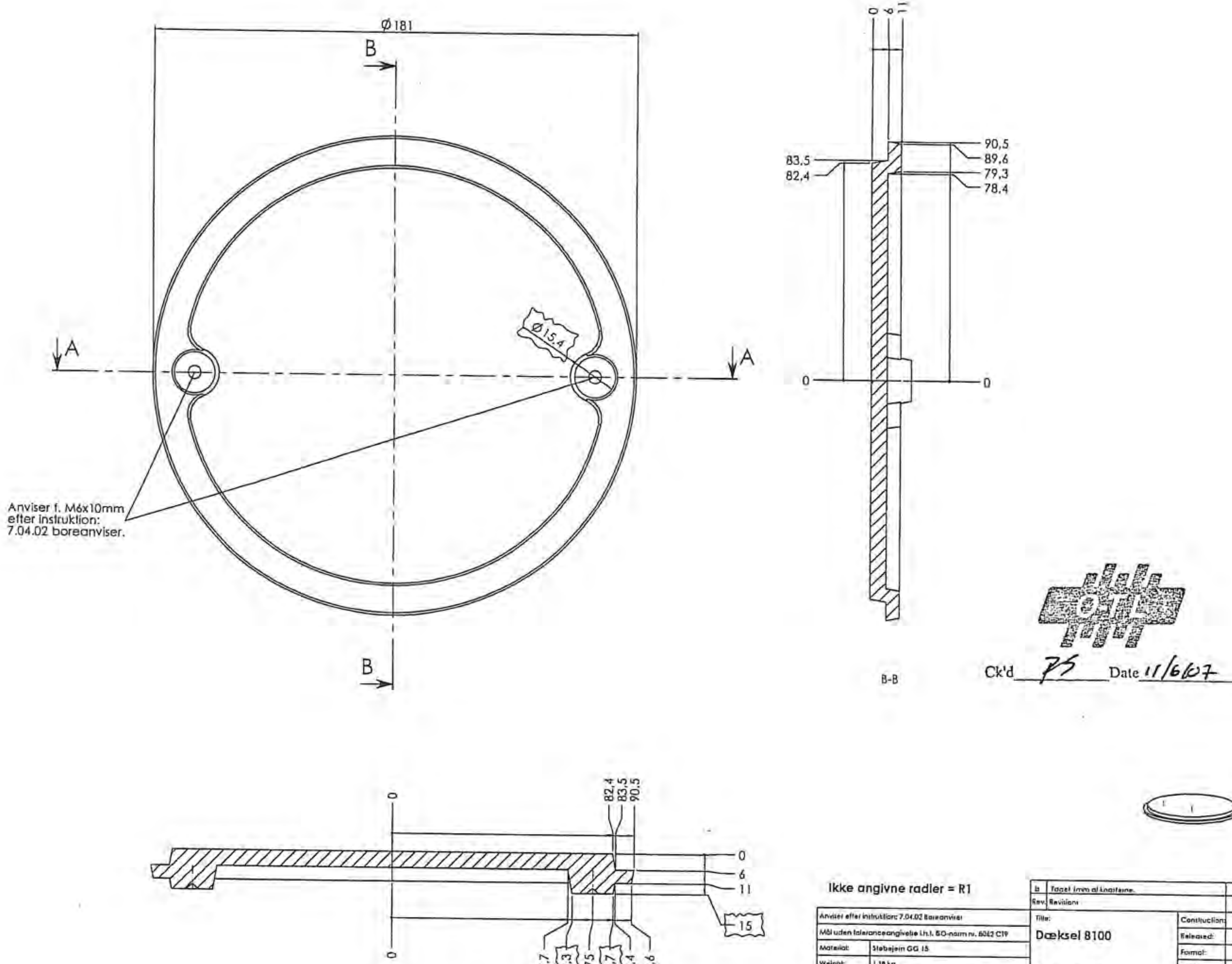


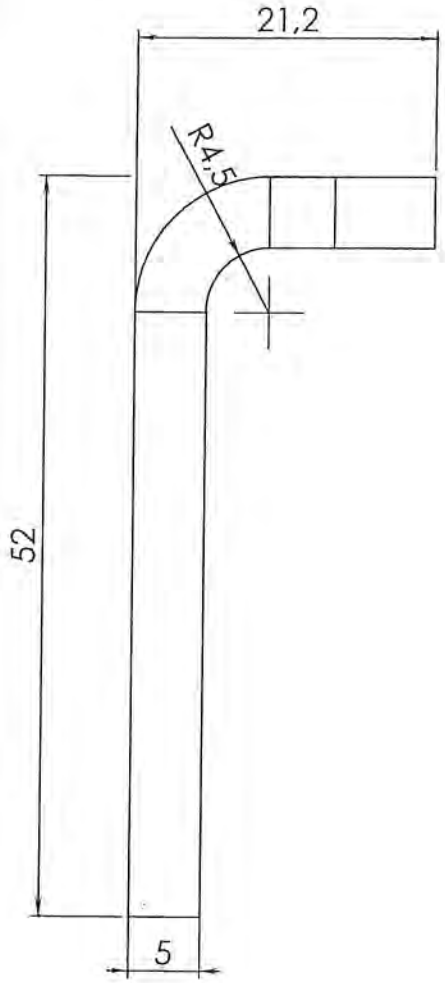
Ck'd *PS* Date *11/6/07*

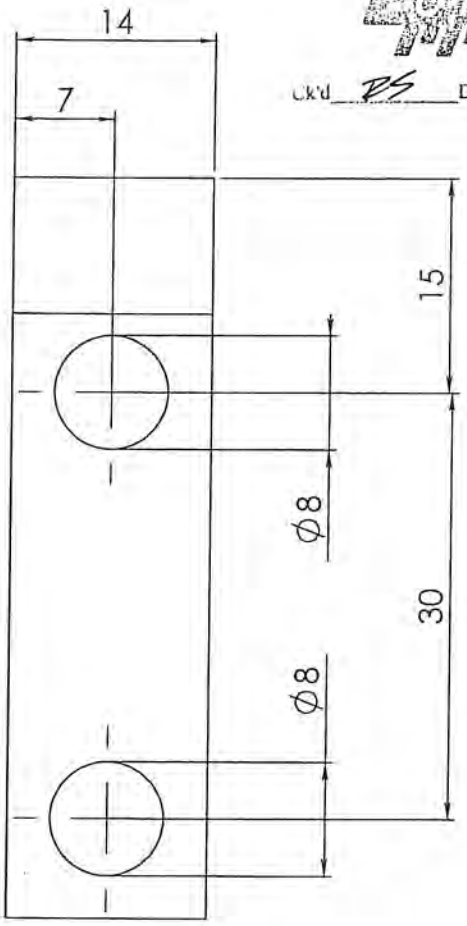
Ikke angivne radier = R1

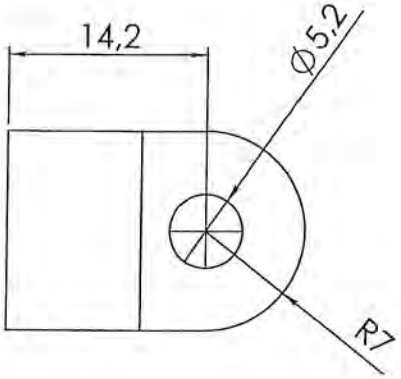
		b	Taget imm af knasterne.		EDU
		Rev.	Revision:		Sign.:
Anviser efter instruktion: 7.04.02 Boreanviser		Title: Dæksel 8100		Construction:	EDU
Mål uden toleranceangivelse i.h.t. BO-norm nr. 6042 C19				Released:	EDU
Materiale:	Støbejern GG 15			Format:	
Weight:	1,18 kg			Scale:	
Model no.	8120	Morsø 8100		Remno.:	348
Drawingtype:	Støbetegning	morsø		Drawing no.: 8100-2	
Location of file:					

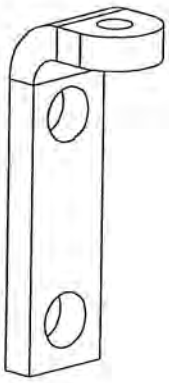
This drawing is Morsø Jernstøberi A/S' property and must not be sold, lended or copied without any written authorization from the co

Chk'd RS Date 11/6/07









Rev.	Revisions	Sign.:	Date:

Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	Title: Hængselsbeslag	Construction:	KDU	13.01.05
		Released:	KDU	29.09.05
Material: SPD Plade		Format:	A4	
Weight: 0,03 kg		Scale:	2:1	
Model no. -	Morsø 8100	Itemno.:	71810100	
Drawingtype: Emnetegning	morsø	Drawing no.:	8100-30 a	
Location of file: U:\UDV\tegninger\8100\8100-30 Hængselsbeslag.SLDPRT				

Date of print: 30-10-2007

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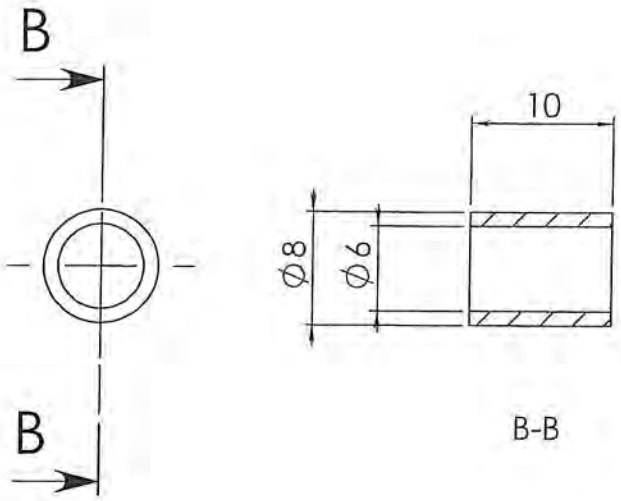
Ck'd PS Date 11/6/07



b	Ændret længde fra 9 mm til 10 mm			RSV	13.01.2006
Rev.	Revisions			Sign.:	Date:
	Title:		Construction:	KDU	18.01.05
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	**Afstandsstykke ø8x1 L=10mm**		Approved:	KDU	29.09.05
Material: Galv	**Hydraulikrør galv.**		Format:	A4	
Weight: 0, kg	**Morsø 3400**		Scale:	2:1	
Model no.			Itemno.:	71810200	
Drawingtype: Emnetegning	morsø		Drawing no.:	8100-31 b	
Location of file: U:\UDV\Tegninger\standardblokke\Afstandsr\Afstandsr ø8x1.SLDPRT					

Date of print: 30-10-2007

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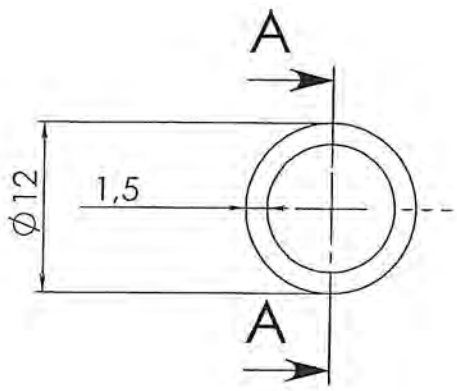
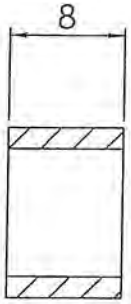
Ck'd PS Date 11/6/07





A-A

		Rev.	Revisions		Sign.:	Date:
		Title:		Construction:	KDU	18.01.05
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m		Afst.rør ø12x1,5		Released:	KDU	29.09.05
Material:				Format:	A4	
Weight:	0, kg			Scale:	2:1	
Model no.	-	Morsø 8100		Itemno.:	71810300	
Drawingtype:	Emnetegning	morsø		Drawing no.:	8100-32 a	
Location of file:	U:\UDV\Tegninger\Standardbibliotek\Afstandsrør\Afstandsrør ø12x1,5.SLDPRT					

Date of print: 30-10-2007

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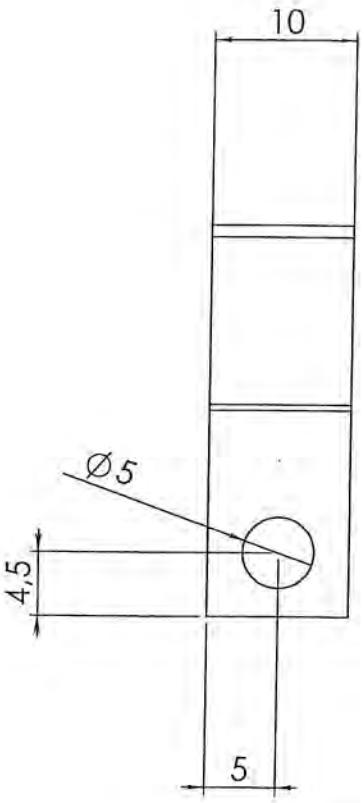
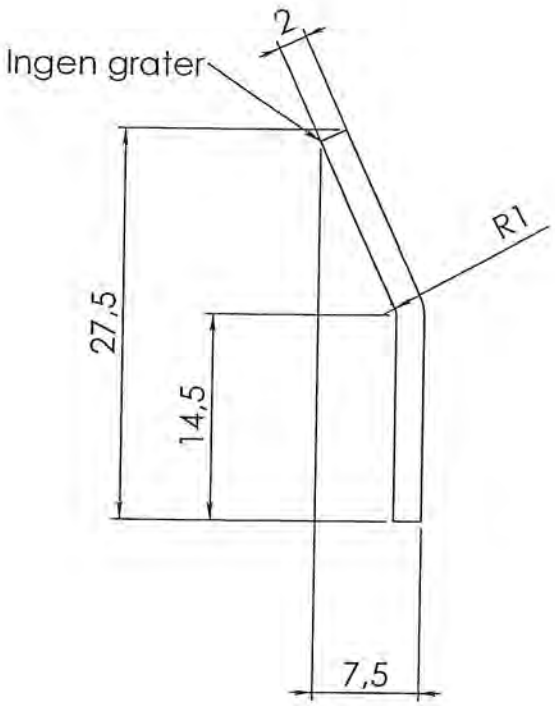
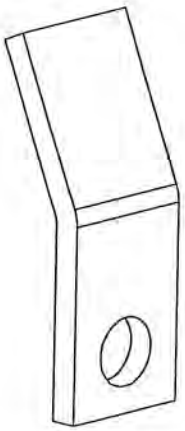
Ck'd RSV Date 11/6/07







		Rev.	Revisions		Sign.:	Date:
		Title:		Construction:	RSV	21.11.05
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m			**Glasclips 8100**	Released:	KDU	06.03.06
Material:	Rustfri stål			Format:	A4	
Weight:	0, kg			Scale:	**2:1**	
Model no.			**Morsø 8100**	Itemno.:	**71814561**	
Drawingtype:	Emnetegning		morsø	Drawing no.:	**8100-132 a**	
Location of file:	M:\LDV\Tegninger\8100\8100-132 Glasclips 8100.SLDPRT					

Date of print: 30-10-2007

This drawing is Morsø Jernstøberi A/S' property and must not be sold, lended or copied without any written authorization from the company.

Section 2

Quality Assurance/Quality Control

QUALITY ASSURANCE/QUALITY CONTROL

OMNI follows the guidelines of ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories," and the quality assurance/quality control (QA/QC) procedures found in *OMNI*'s Quality Assurance Manual.

OMNI's scope of accreditation includes, but is not limited to, the following:

- ANSI (American National Standards Institute) for certification of product to safety standards.
- To perform product safety testing by the International Approval Service (formerly ICBO ES) under accreditation as a testing laboratory designated TL-130.
- To perform product safety testing as a "Certification Organization" by the Standards Council of Canada (SCC).
- Serving as a testing laboratory for the certification of wood heaters by the U.S. Environmental Protection Agency.

This report is issued within the scope of *OMNI*'s accreditation. Accreditation certificates are available upon request.

Sample Analysis

Analysis Worksheets
Tared Filter and Beaker Data
Solvent Blank Data

Date Placed in Desiccator	12-Oct-07	Balance ID Number	OMNI-00023	
Time Placed in Desiccator	2:15 PM	Audit Weight ID Number	OMNI-00131	
Technician	Morgan	Thermometer/Hygrometer ID Number		

AE Glass 102 mm Filter Tares

OMNI-Test Laboratories, Inc

102 mm Filters ID Number													
	Date:	10/15/2007	10/16/2007										
	Time:	9:00 AM	6:30 AM										
	RH %:	16	14		0		0						
	T (F):	72	75		0		0						
	Tech.:	Morgan	Morgan										
	Audit:	0.5001	0.5001		0		0						
N454		0.5718	0.5716	X	0		0		Morso	6100 Series	192-S-15-3	1	
N455		0.5851	0.585	X	0		0		Morso	6100 Series	192-S-15-3	1	
N456		0.5827	0.5824	X	0		0		Morso	6100 Series	192-S-15-3	2	
N457		0.579	0.5788	X	0		0		Morso	6100 Series	192-S-15-3	2	
N458		0.581	0.5809	X	0		0		Morso	6100 Series	192-S-15-3	3	
N459		0.5831	0.5831	X	0		0		Morso	6100 Series	192-S-15-3	3	
N460		0.5923	0.592	X	0		0		Morso	6100 Series	192-S-15-3	4	

Date Placed in Desiccator	01-Nov-07	Balance ID Number	OMNI-00023
Time Placed in Desiccator	6:50 AM	Audit Weight ID Number	OMNI-00131
Technician	Morgan	Thermometer/Hygrometer ID Number	OMNI-00291

AE Glass 102 mm Filter Tares

OMNI-Test Laboratories, Inc

102 mm Filters ID Number														
	Date:	11/2/2007	11/2/2007											
	Time:	6:55 AM	1:10 PM											
	RH %:	19	21		0		0							
	T (F):	74	74		0		0							
	Tech.:	Davis	Morgan											
	Audit:	0.5001	0.5001		0		0							
N461		0.569	0.569	X	0		0		Morso		6100 Series		192-S-15-3	4	A

...ate Pl... ...n Des...	17-C...	Ba... ID Nu...	...NI-00...
Time Placed in Desiccator	10:00 AM	Audit Weight ID Number	OMNI-00131
Technician	Davis	Thermometer/Hygrometer ID Number	OMNI-00291

250 ml Beaker Tares

OMNI-Test Laboratories, Inc

250 ml Beakers ID Number								Manufacturer	Appliance	Project No.	Run	Train
Date:	10/18/2007	10/19/2007		10/24/2007								
Time:	11:30 AM	10:00 AM		3:05 PM								
RH %:	16	18		24		0						
T (F):	73	74		73		0						
Tech.:	R. Smith	Davis		Davis								
Audit:	0.5001	0.5001		0.5001		0						
2189	103.0408	103.0398		103.0396	X	0		Morso	6100 Series	192-S-15-3	2	A
2206	102.8326	102.8313		102.8309	X	0		Morso	6100 Series	192-S-15-3	4	A
2312	108.3702	108.3693		108.3689	X	0		Morso	6100 Series	192-S-15-3	1	A
2310	111.496	111.4949		111.4945	X	0		Morso	6100 Series	192-S-15-3	3	A

OMNI-Test Laboratories, Ir.
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: Morso
Model: 6100 Series
Project #: 192-S-15-3 Tracking #: 1120
Date: 11-01-07 Test Crew: K. Morgan Run #: 1
Sample Train #: Train assembled by: K. Morgan
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI -
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter	11-2-07	14:15	.6018	.5001	18	74	BL
Lab ID #	11-6-07	11:36	.6009	.5001	21	75	BL
ID # N455	11-7-07	0815	.6009	.5001	22	74	BL
Tare wt. .5850							
D/T in desiccator 11-01-07 13:10							
Preliminary wt.: .6017							
Rear Filter	11-2-07	14:15	.5717	.5001	18	74	BL
Lab ID #	11-6-07	11:36	.5713	.5001	21	75	BL
ID # N454							
Tare wt. .5716							
D/T in desiccator: 11-01-07 13:10							
Preliminary wt.: .5716							
Acetone Rinse	11-3-07	16:35	108.3726	.5001	19	73	BL
Lab ID #	11-6-07	11:36	108.3720	.5001	21	75	BL
Beaker # 2312	11-7-07	0815	108.3724	.5001	22	74	BL
Tare wt. 108.3689							
Volume 100 ml							
Cleaned by: IL							
Solvent #: SA079							
D/T in desiccator: 11-02-07 16:30							
Preliminary wt.: 108.3757							

Technician signature: BL Date: 11-7-07

18.4

OMNI-Test Laboratories, Inc.
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: Morso
Model: 6100 Series
Project #: 192-S-15-3 Tracking #: 1120
Date: 11-01-07 Test Crew: K. Morgan Run #: 2
Sample Train #: _____ Train assembled by: K. Morgan
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI -
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter Lab ID # _____ ID # N457 Tare wt. .5788 D/T in desiccator 11-01-07 17:15 Preliminary wt.: .5846	11-2-07	17:24	.5848	.5001	18	73	BL
	11-6-07	11:36	.5844	.5001	21	74	BL
Rear Filter Lab ID # _____ ID # N456 Tare wt. .5824 D/T in desiccator: 11-01-07 17:15 Preliminary wt.: .5817	11-2-07	17:24	.5817	.5001	18	73	BL
	11-6-07	11:36	.5816	.5001	21	74	BL
Acetone Rinse Lab ID # _____ Beaker # 2189 Tare wt. 103.0396 Volume 100 ml Cleaned by: IL Solvent #: SA079 D/T in desiccator: 11-02-07 16:30 Preliminary wt.: 103.0464	11-3-07	16:35	103.0433	.5001	19	73	BL
	11-6-07	11:36	103.0431	.5001	21	75	BL

Technician signature: _____ Date: 11-7-07

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OMNI-Test Laboratories, Ir.
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: Morso
Model: 6100 Series
Project #: 192-S-15-3 Tracking #: 1120
Date: 11-02-07 Test Crew: K. Morgan Run #: 3
Sample Train #: _____ Train assembled by: K. Morgan
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI -
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter Lab ID # _____ ID # N459 Tare wt. .5831 D/T in desiccator 11-02-07 13:00 Preliminary wt.: .6001	11-3-07	16:35	.6003	.5001	19	73	BL
	11-6-07	11:36	.5998	.5001	21	74	BL
Rear Filter Lab ID # _____ ID # N458 Tare wt. .5809 D/T in desiccator: 11-02-07 13:00 Preliminary wt.: .5804	11-3-07	16:35	.5802	.5001	19	73	BL
	11-6-07	11:36	.5801	.5001	21	74	BL
Acetone Rinse Lab ID # _____ Beaker # 2310 Tare wt. 111.4945 Volume 100 ml Cleaned by: K Solvent #: SA079 D/T in desiccator: 11-5-07 0915 Preliminary wt.: 111.4996	11-6-07	11:36	111.4976	.5001	21	75	BL
	11-7-07	0815	111.4978	.5001	22	74	BL

Technician signature: _____ Date: 11-7-07

OMNI-Test Laboratories, Ir.
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: Morso
Model: 6100 Series
Project #: 192-S-15-3 Tracking #: 1120
Date: 11-02-07 Test Crew: K. Morgan Run #: 4
Sample Train #: _____ Train assembled by: K. Morgan
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI -
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter Lab ID # _____ ID # N461 Tare wt. .5690 D/T in desiccator 11-02-07 15:55 Preliminary wt.: .5785	11-3-07	16:35	.5788	.5001	19	73	BL
	11-6-07	11:36	.5784	.5001	21	74	BL
Rear Filter Lab ID # _____ ID # N460 Tare wt. .5920 D/T in desiccator: 11-02-07 15:55 Preliminary wt.: .5918	11-3-07	16:35	.5918	.5001	19	73	BL
	11-6-07	11:36	.5915	.5001	21	74	BL
Acetone Rinse Lab ID # _____ Beaker # 2206 Tare wt. 102.8309 Volume 100 ml Cleaned by: _____ Solvent #: SA079 D/T in desiccator: 11-5-06 0915 Preliminary wt.: 102.8379	11-6-07	11:36	102.8363	.5001	21	75	BL
	11-7-07	0915	102.8366	.5001	22	74	BL

Technician signature: _____ Date: 11-7-07

C T Environmental Services, Inc.
OMNI-Test Laboratories, Inc.
Beaverton, OR Phone (503) 643-3788

Acetone Solvent Blank Analysis Worksheet

Date: 3-1-07 By: B Davis Balance ID #: OMNI – 00023

Manuf. Lot #: C18120ISP Solvent Bottle #: SA 079 Audit Weight ID #: OMNI – 00131
(Balance audit mfr. std.: 500 ± 0.72 mg)

Mls. Sample	ID No.	Tare Weight	Date & Time in Dessicator	Weighing Record				Initials	Calculations & Remarks
				Date	Time	Weight	Audit Weight		
150	1007	111.5159	3-1-07 & 1550 111.5193	3-2-07 3-7-07	15:55 08:20	111.5188 111.5184	.504 .504	BD BD	2.5/150 = .016667
150	245	93.3410	3-1-07 & 1550 93.3444	3-2-07 3-7-07	15:55 08:20	93.3441 93.3437	.504 .504	BD BD	2.7/150 .01800 .034667
			&						BD .051334/2 = .0173 mg/mL

Technician Signature: [signature] Date: 3-15-07

Checked by: [signature] Date: 3/19/07 Approved by: [signature] Date: 3/18/07

2-11 OF 2-53

Calibrations

Methods 28 and 5G

ID #	Lab Name/Purpose	Log Name	Attachment Type
1	Calibrator Dry Gas Meter	Standard Test Meter – Rockwell Int'l	Calibration Certificate
23	Scale/Analytical Balance	Analytical Balance – Mettler Instrument	Calibration Certificate
32	Vaneometer	Vaneometer, Air Velocity Meter – Dwyer	Calibration Log
33	Manometer	Microtector – Dwyer	Manual
112	Thermometer	Temperature Controller Meter – Omega	Calibration Log
126	Draft Gauge	Magnehelic, 0-0.25" H_2O – Dwyer	Calibration Log
131	500 mg Weight	Standard Weight, 500 mg – Ohaus	Calibration Certificate
156	Incline Manometer	Incline Manometer, 0-10" – Dwyer	Calibration Log
183	Moisture Meter	Moisture Meter – Delmhorst	Manual
185	Scale	Platform Scale – Weight-Tronix	Service Work Order
209	Barometer	Barometer – Princo	Manual Cover
255	10 lb Weight	Standard Weight, 10 lb	Calibration Certificate
291	Relative Humidity Gauge	Digital Hygrometer/Thermometer – Omega	Calibration Certificate
300	Stopwatch	Stopwatch – Sportline	Calibration Log
322	Dry Gas Meter	Control Module – Apex	Calibration Log

DICK MUNNS COMPANY

Liquid and Gas - Flowmeter Calibration Service
10572 Calle Lee - 138 • Los Alamitos, California 90720
Telephone (714) 827-1215 • Telefax (714) 827-0823

CERTIFICATE OF CALIBRATION

Client Name:	OMNI TEST LABS	Calibration Date:	05-03-2007
Reference Number:	PO# OTL-07-225	Calibration Due:	05-03-2008
Instrument Manufacturer:	ROCKWELL	Procedure:	NAVAIR-17-20MG-02
Instrument Description:	P.D. METER	Calibration Fluid:	Air @14.7PSIA 70F.
Model Number:	S-275	Standard(s) Used:	A4 DUE 2-2011
Serial Number:	6843901(ID#OMNI00001)	NIST Traceability Per:	MS13141,MS13431
Rated Uncertainty:	+/- .5% RD.	Ambient Conditions:	763 mmHGA, 41% RH
Uncertainty Given:	0.185 @ 95%; K=2	Certificate/File:	426663

	IND. SCFM	ACT. SCFM	C.FACTOR
1	0.250	0.250	1.00001
2	0.500	0.500	1.00001
3	0.751	0.750	0.99868
4	1.001	1.000	0.99901
5	1.502	1.500	0.99868
6	2.004	2.000	0.99796
7	2.507	2.500	0.99722
8	3.009	3.000	0.99702
9	3.511	3.500	0.99688
10	4.015	4.000	0.99627

** REPAIRED: NOT WORKING AS RECEIVED; NEEDLE MOVEMENT REPAIRED **

All instruments used in the performance of the above calibration have direct traceability to the National Institute of Standards and Technology (NIST). The accuracy ratio between the calibration standards used and the unit under test is a minimum of 4:1, unless otherwise noted. Calibration has been performed per the above listed procedure number, in accordance with ISO 10012-1,17025, ANSI/NCSL-Z-540-1, and/or MIL-STD-45662A. CONDITION AS: RECEIVED(X) AS LEFT( ). WITHIN SPECS:(X)YES ( )NO.

Calibration Performed By:

PABLO ACOSTA

Approved By:

R. L. Munns

This certificate may not be altered and may be reproduced only in its entirety.

Certificate of Calibration 360456

Omni-Test Laboratories
5465 SW Western
Suite G
Beaverton, OR 97005

Cust ID: 56
OnSite
PO: OTL-06-127
Authorized By:

JJ Calibrations, Inc.

ACCREDITED
0723.01

Make: Mettler
Model: AE200
Noun: SCALE
Serial #: 010644
Property #: OMNI-00023
Department: NO
User:
Procedure: CP 27
Accuracy: ±0.01% OF APPLIED WEIGHT

Order Date: 11/08/2006
Calibrated on: 11/08/2006
*Recommended Due: 05/08/2007
Environment: 17°C 49% RH
As Received: Within Tolerance
As Returned: Within Tolerance
Action Taken: Calibrated
Technician: 92
ID Barcode: CVUH

Remarks
Refer to attachment for measurement results.

* Any number of factors may cause the calibration item to drift out of calibration before the recommended interval has expired

Standards Used

Std ID	Manufacturer	Model	Nomenclature	Due Date	Trace ID
256A	Rice Lake	W0133K	WEIGHT SET	08/11/2008	326425
503A	Rice Lake	1mg-200g TYPE O	O CLASS WEIGHT SET	09/28/2007	353816

This instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual and is traceable to the National Institute of Standards and Technology (NIST). The quality system and this certificate are in compliance with ANSI/NCSL Z540-1-1994, ISO/IEC 17025-1999, ISO 10012-1, the ISO 9000 family and QS 9000. The expanded uncertainties of measurements for this calibration are based upon 95% (2 sigma) confidence limits. The results reported herein apply only to the calibration of the item described above. This report may not be reproduced, except in full, without written approval of JJ Calibrations.

Reviewer

Inspector

4 Issued 11/09/2006 Rev # 12

7007 SE Lake Rd Portland, OR 97267-2105 Phone 503 786 3005 FAX 503 786 2994 www.jjcalibrations.com

JJ Calibrations, Inc.

Manufacturer: Mettler
Model: AE200
Nomenclature: 200g Scale
Serial: 010644

Certificate #: 360456
Date: 08Nov2006
Technician: 92
Calibration Interval: 6 Months

Parameter		Reference Standard	UUT Before	UUT After	UUT ± Limit	Uncertainty ±
Mass						
		01 g	1.0000g	1.0000g	0.0001 g	N/A
		10 g	10.0001g	10.0001g	0.001 g	N/A
		50 g	50.0002g	50.0002g	0.005 g	N/A
		100 g	100.0004g	100.0004g	0.010 g	N/A
		200 g	200.0011g	200.0011g	0.020 g	N/A

Supplement Data Sheet
Bold Italics indicates Out of Tolerance Value.

CALIBRATION RECORD

Vaneometer Air Velocity Meter – OMNI-00032

CALIBRATION/SERVICE RECORD			
DATE	**BY**	**RESULTS**	**DATE OF NEXT CALIBRATION**
3/10/98	BD	Installed new vane from factory	9/10/98
9/3/98	BD	Installed new vane from factory	3/3/99
3/8/99	JS	Installed new vane from factory	9/8/99
9/10/99	BD	Installed new vane from factory	3/10/00
3/10/00	BD	Installed new vane from factory	9/10/00
9/13/00	BD	Installed new vane from factory	3/13/01
5/4/01	BD	Installed new vane from factory	11/4/01
11/30/01	BD	Installed new vane from factory	5/30/02
3/20/02	BD	Installed new vane from factory	9/20/02
9/14/02	BD	Installed new vane from factory	3/14/03 BD
3/14/03	BD	Installed new vane from factory	9/14/03
1-19-04	BD	Installed new vane from factory	7-19-04
7-16-04	BD	Installed new vane from factory	1-16-05
1-16-05	BD	Installed new vane from factory	7-16-05
7-14-05	BD	Installed new vane from factory	1-14-06
1-14-06	BD	Installed new vane from factory	7-14-06
7-10-06	BD	Installed new vane from factory	1-10-07
1-10-07	BD	Installed new vane from factory	7-10-07
		Installed new vane from factory	
		Installed new vane from factory	
		Installed new vane from factory	
		Installed new vane from factory	

Negative Pressure or Vacuum Measurement

Zero the gage. Connect the source of vacuum or negative pressure to the right side gage connection (5) and proceed as described under Positive Pressure Measurement Section above. Remember that the pressure measured in this way is negative.

Differential Pressure Measurement

Differential pressures may be measured by connecting the higher (more positive) pressure to the left connection (2) and the lower pressure to the right connection (5).

Storage

Turn meter circuit switch to "off" position and withdraw the point well clear of fluid (by turning Micrometer counter-clockwise) when gage is not in use. This will conserve the batteries and minimize build-up of oxides, etc., on the point. Keep the unit covered and in an area free of strong solvent fumes.

Maintenance

When the meter reading becomes reduced or the pointer movement gets sluggish (with the circuit on and point in fluid), the following should be done:

1. Remove the point (by unscrewing) and clean the tip lightly using fine crocus cloth. Wipe off all grit and dirt with a clean rag, reassemble and recheck meter operation.
2. If the meter operation continues to be sluggish, replace the size AA, 1½ volt battery. (Replace the battery at least once a year to avoid deterioration of battery and damage to gage. Leakproof alkaline battery is recommended.)

To replace the battery, remove center screw (10) located in the back of the electronic enclosure. Cover (9) will come off exposing the battery. Pull the old battery out and push a new battery into the battery holder with the positive (center) terminal to the right (to the end marked with a + on the holder).

If the fluid becomes contaminated and requires replacement; empty old fluid from gage; flush out with clear water and replace with distilled water and Dwyer A126 Fluorescein Green Color Concentrate mixed 3/4 oz. concentrate to each quart of water. (CAUTION: Do not substitute other gage fluids as proper gage operation depends on use of the specified gage fluid to provide proper surface tension, wetting ability and electrolyte capability with unity specific gravity.)

If the gage bore is very dirty, a mild soap solution may be used to aid in cleaning prior to flushing with clear water. (CAUTION: Do not clean with liquid soaps, special solvent, degreasers, aromatic hydro-carbons, etc. Such cleaners and solvents frequently contain chlorine, fluorine, acetone and related compounds which will permanently damage the gage, and prevent proper operation.

If meter becomes inoperative and cannot be made to operate properly by cleaning point tip or replacing battery, return the entire gage to Dwyer Instruments, Inc., for service.

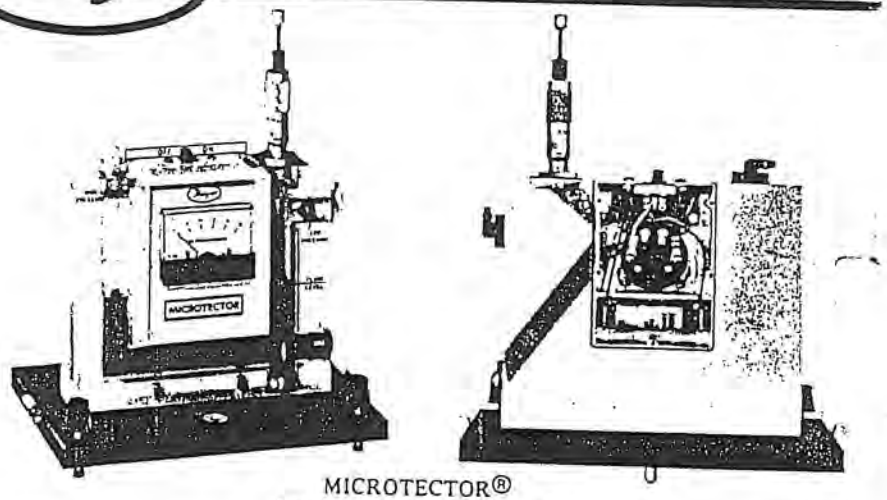
*"Microtector"**
A Product From
Dwyer Instruments, Inc
"The Low Pressure People"

Copyright 1985, Dwyer Instruments, Inc

Form No. 38-440190-00
Litho in U.S.A. 1/85

DWYER INSTRUMENTS, INC.
P.O. Box 373, Michigan City, Indiana 46360, U.S.A.
Phone: 219/872-9141

MICROTECTOR®
Operating and Maintenance Instructions



MICROTECTOR®
Specifications and Features*

Time Proven Hook Gage Manometer Combined with Modern Electronics For Easier, Faster, More Accurate Precision Measurements.

Accurate and Repeatable to ± .00025 inches water column.

Pressure Range 0-2" w.c. Positive, Negative or Differential Pressures.

Non Toxic and Inexpensive Gage Fluid Consists of Distilled Water Mixed with a Small amount of Fluorescein Green Color Concentrate.

Convenient, Portable, Light Weight, and Self-Contained, the Unit Requires No External Power Connections and is Operated by a 1½ Volt Penlight Cell.

A.C. Detector Current Eliminates Point Plating, Fouling and Erosion.

Micrometer Complies with Federal Specification GGG-C-105A and is Traceable to a Master at the National Bureau of Standards.

Three Point Mounting with Dual Leveling Adjustment and Circular Level Vial Assure Rapid Set Up.

Durablock® Precision Machined Acrylic Plastic Gage Body.

Sensitive 0-50 Microamp D.C. Meter Acts as Detector and Also Indicates Battery and Probe Condition.

Heavy One Half Inch Thick Steel Base Plate Provides Steady Mounting.

Top Quality Glass Epoxy Circuit Board and Solid State-Integrated Circuit Electronics.

Electronic Enclosure of Tough Molded Styrene Acrylonitrile Provides Maximum Protection to Components Yet Allows Easy Access to Battery Compartment.

Rugged Sheet Steel Cover and Carrying Case Protects the Entire Unit When Not In Use.

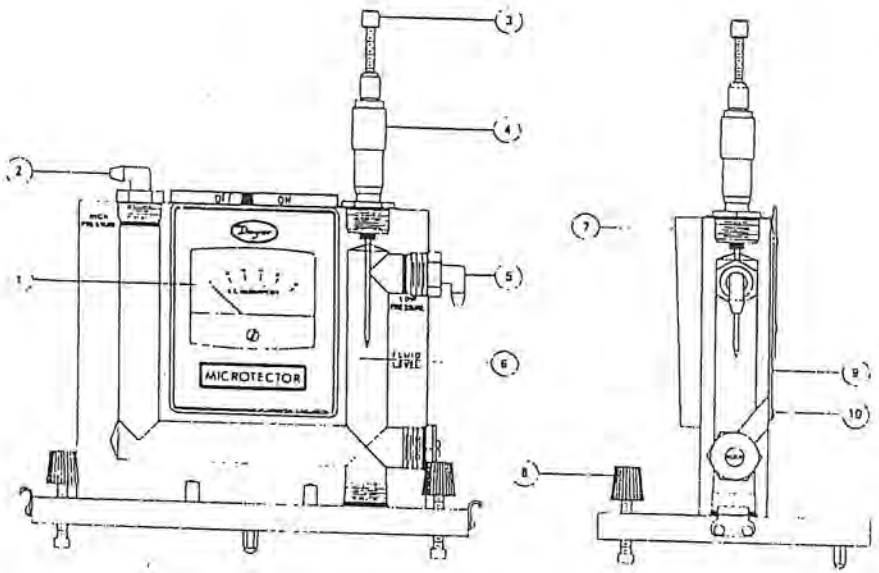
Accessories Included are (2) 3 Foot Lengths Tygon Tubing, (2) 1/8" Pipe Thread Adapters and 3/4 oz. bottle of Fluorescein Green Color Concentrate with Wetting Agent.

Maximum Pressure 100 PSIG (With optional Pipe Thread Connections).

**Patent No. 3,726,142*

DWYER INSTRUMENTS, INC.
P. O. BOX 373 • MICHIGAN CITY, INDIANA 46360, U.S.A.
Telephone 219/872-9141

2-17 OF 2-53



MICROTECTOR® GAGE

Precision Pressure Measurement

The Dwyer Microtector® combines the time proven principles of the Hook Gage type manometer and modern solid state integrated circuit electronics. It provides an inexpensive means of achieving accuracy and repeatability within ± .00025 inches water column throughout its 0 to 2 inches w.c. range. It is truly a new standard in precision pressure measuring devices.

Principles of Operation

A pressure to be measured is applied to the manometer fluid which is displaced in each leg of the manometer by an amount equal to ½ the applied pressure. A micrometer mounted point is then lowered until contacts the manometer gage fluid. The instant of contact is detected by completion of a low power A.C. circuit. Current for this circuit is supplied by a 1½ volt penlight cell feeding two semiconductor amplifiers which act as a free-running multivibrator operating at a frequency of approximately two kilohertz. Completion of the A.C. circuit activates a bridge rectifier which provides the signal for indication on a sensitive (0 to 50 microamps) D.C. microammeter.

On indication of contact the operator stops lowering the point and reads the micrometer which indicates one half the applied pressure. By interpolating eight divisions, (each being .000125" w.c.) between .001 micrometer graduations, a total accuracy of .00025 can easily be achieved. The micrometer complies with Federal Specification GGG-C-105A and is traceable to a master at the National Bureau of Standards.

Locating and Opening

Stand the Microtector® and case on a firm flat level surface. Remove the cover by releasing the latches and lifting straight up. If it is necessary to move the gage without case, handle only the base plate or clear acrylic block. (CAUTION: Do not handle gage by grasping meter-electronic package housing Item 7 on drawing.)

Fluid Level

Level the gage by adjusting the two front leveling screws (Item 8 on drawing) until the bubble in the spirit level is centered in the small circle. After leveling the gage, open both rapid shut off valve tube connectors (2 and 5). Back off the Micrometer (4), if necessary, to make sure that the point is not immersed in the gage fluid. The fluid level in the gage should now coincide with the mark on the right hand bore plus or minus approximately 1/32 inch (6). If the level of fluid is too high, fluid can be removed with an eye dropper pipette or carefully poured out of the right connection (5). If the level is too low, remove the top left rapid shut off valve tube connector (2), and add distilled water pre-mixed with the proper amount of Dwyer green concentrate. (See maintenance instruction for proportions.) After correcting the fluid level, reinstall the rapid shut off connectors and with them in the open position, relevel the Microtector.® The gage is now ready to be zeroed.

Zeroing

Turn the Micrometer barrel (4) until its lower end just coincides with the zero mark on the internal vertical scale *and* the zero on the barrel scale coincides with the vertical line on the internal scale. Note that the internal scale is graduated every .025" from 0 to 1.00 inch and the barrel scale is graduated in one thousandths from 0 to .025." Turn the meter circuit switch at the top of gage to the "on" position. While holding the barrel at the zero position (and with the gage level), raise or lower the point by turning the top knurled knob (3) until the point is above, but near the fluid.

Check to be sure that the meter (1) registers zero. Watch the meter, hold the barrel (4) and lower the point slowly by turning the top knurled knob (3). As the knob is turned, the point will contact the fluid and the meter pointer will move from zero to some upscale position. After making contact, turn the point out of the fluid by turning the Micrometer barrel counter-clockwise to a reading of .010 or more. Again watch the meter and, this time, lower the point by turning the Micrometer barrel. The point position where the meter pointer begins to move up scale is the zero position. This position should correspond to zero reading on the Micrometer. Adjust the point in relation to the Micrometer barrel by turning the top knob while holding the barrel steady. Repeat lowering the point, watching the meter for contact, and adjusting the point until the zero position and zero reading exactly coincide. The gage is now zeroed and should not be moved.

An alternate method of zeroing and reading can be used wherein, instead of zeroing the gage completely, a zero correction reading is taken and recorded then subtracted from the final reading. Comparable results can be obtained with either method.

Positive Pressure Measurement

With the fluid at its proper level, a pressure of 2.0" water column maximum can be measured. Positive pressure should be applied to the top left connection (2) with the Micrometer zeroed as described above. This will permit simple direct reading to be taken.

After an unknown pressure has been applied at the top left connection, the fluid level will drop in the left bore and rise over the point in the right bore. Note the indicating meter point has moved upscale because the point is immersed in the fluid. Turn the Micrometer counter-clockwise until the point leaves the fluid as indicated by the meter pointer dropping to zero or scale. Then slowly turn the Micrometer down until its point just touches the fluid surface causing movement of the meter pointer. Withdraw the point and repeat several times noting each time the Micrometer reading where the meter pointer movement begins. The average of these readings multiplied by two is the pressure applied to the gage. (Avg. reading x 2 = pressure applied in inches w.c. The degree of uncertainty for the operator and instrument is indicated by the difference in these readings.)

When the readings are complete the pressure should be removed and the zero-setting of the Microtector® rechecked. Any change in the zero position will indicate inaccurate readings. Should this happen the zero-set and pressure measurement procedure should be repeated.

2-18 OF 2-53

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If the meter operation continues to be sluggish, replace the size AA, 1½ volt battery. (Replace the battery at least once a year to avoid deteriora- tion of battery and damage to gage. Leakproof alkaline battery is recom- mended.)

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If the fluid becomes contaminated and requires replacement; empty old fluid from gage; flush out with clear water and replace with distilled water and Dwyer A126 Fluorescein Green Color Concentrate mixed 3/4 oz. concentrate to each quart of water. (CAUTION: Do not substitute other gage fluids as proper gage operation depends on use of the specified gage fluid to provide proper surface tension, wetting ability and electrolyte capability with unity specific gravity.)

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If meter becomes inoperative and cannot be made to operate properly by cleaning "hook" tip or replacing battery, return the entire gage to Dwyer Instruments, Inc., for service.

"Microtector" ®
A Product From
Dwyer Instruments, Inc.
"The Low Pressure People"

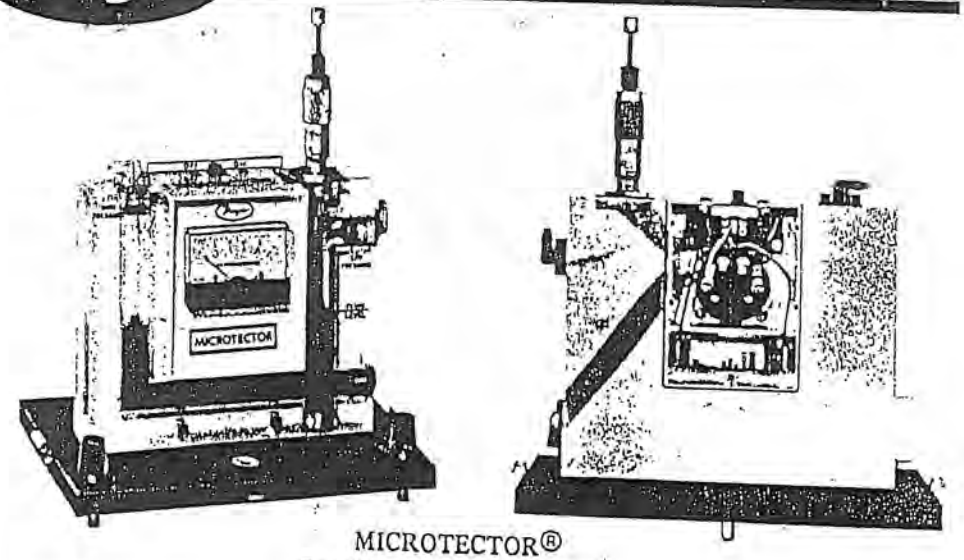
Copyright 1970, Dwyer Instruments, Inc. ®

38-440190-00

DWYER INSTRUMENTS, INC.
P.O. Box 373, Michigan City, Indiana 46360, U.S.A.
Phone: Area 219/872-9141
Direct Chicago Line: Area 312/733-7883

MICROTECTOR®

Operating and Maintenance Instructions



MICROTECTOR®

Specifications and Features*

Time Proven Hook Gage Manometer Combined with Modern Electronics For Easier, Faster, more Accurate Precision Pressure Measurements.

~~Accurate and Repeatable to ± .0002 inches water column (.000009 P.S.I.).~~

Pressure Range 0-2" w.c. Positive, Negative or Differential Pressures.

Non Toxic and Inexpensive Gage Fluid Consists of Distilled Water Mixed with a Small Amount of Dwyer Color and Wetting Agent Concentrate.

Convenient, Portable, Light Weight, and Self-Contained, the Unit Requires No External Power Connections and is Operated by a 1½ Volt Penlight Cell.

A.C. Detector Current Eliminates Hook Plating, Fouling and Erosion.

Micrometer Complies with Federal Specification GGG-C-105A and is Traceable to a Master at the National Bureau of Standards.

Three Point Mounting with Dual Leveling Adjustment and Circular Level Assure Rapid Set Up.

Durablock® Precision Machined Acrylic Plastic Gage Body.

Sensitive 0-50 Microamp D.C. Meter Acts as Detector and Also Indicates Battery and Hook Probe Condition.

Heavy One Half Inch Thick Steel Base Plate Provides Steady Mounting.

Top Quality Glass Epoxy Circuit Board and Solid State-Integrated Circuit Electronics.

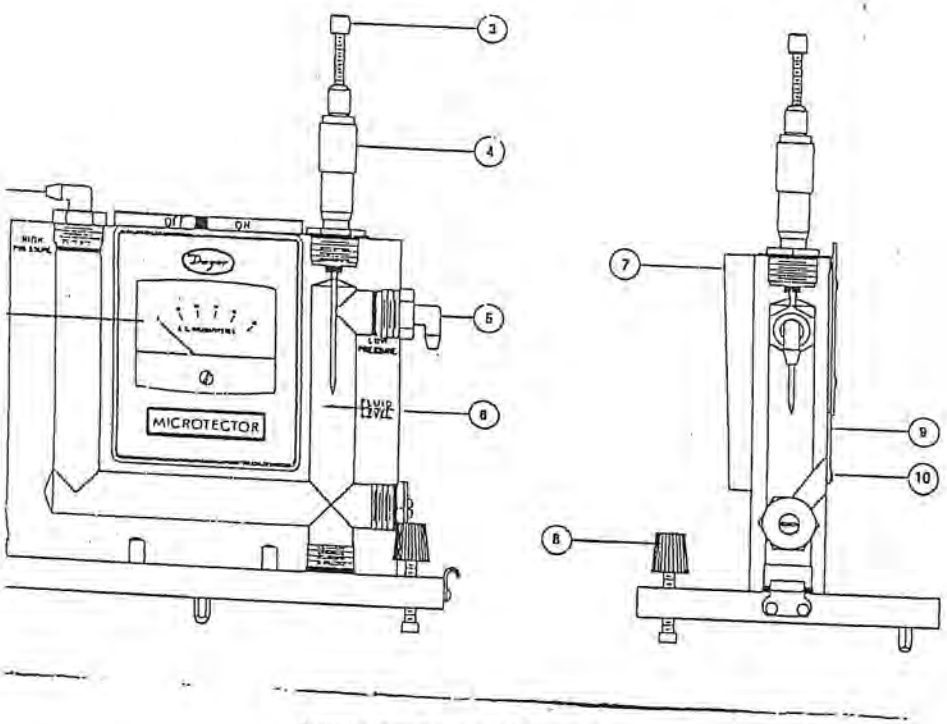
Electronic Enclosure of Tough Molded Styrene Acrylonitrile Provides Maximum Protection to Components Yet Allows Easy Access to Battery Compartment.

Rugged Sheet Steel Cover and Carrying Case Protects the Entire Unit When Not in Use.

Accessories Included are (2) 3 Foot Lengths Tygon Tubing, (2) 1/8" Pipe Thread Adapters and 3/4 oz. bottle of Fluorscein Green Color Concentrate with Wetting Agent.

**Patent Applied For*

DWYER INSTRUMENTS, INC. P.O. BOX 373 MICHIGAN CITY, INDIANA Telephone 219/872-9141 or



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On indication of contact the operator stops lowering the hook and reads the micrometer which indicates one half the applied pressure. By reading the micrometer to the closest .000125 inches a total accuracy of .00025 inches w.c. is easily achieved. The micrometer complies with Federal Specification GGG-C-105A and is traceable to a master at the National Bureau of Standards.

Locating and Opening

Stand the Microtector and case on a firm flat level surface. Remove the cover by releasing the latches and lifting straight up. If it is necessary to move the gage without case, handle only the base plate or clear acrylic block. (CAUTION: Do not handle gage by grasping meter-electronic package housing Item 7 on drawing.)

Fluid Level

Level the gage by adjusting the two front leveling screws (Item 8 on drawing) until the bubble in the spirit level is centered in the small circle. After leveling the gage, open both rapid shut off valve tube connectors (2 and 5). Back off the Micrometer (4), if necessary, to make sure that the point or "Hook" is not immersed in the gage fluid. The fluid level in the gage should now coincide with the mark on the right hand bore plus or minus approximately 1/32 inch (6). If the level of fluid is too high, fluid can be removed with an eye dropper, pipette or carefully poured out of the right connection (5). If the level is too low, remove the top left rapid shut off valve tube connector (2), and add distilled water pre-mixed with the proper amount of Dwyer green concentrate. (See maintenance instruction for proportions.) After correcting the fluid level, reinstall the rapid shut off connectors and with them in the open position, relevel the Microtector. The gage is now ready to be zeroed.

Zeroing

Turn the Micrometer barrel (4) until its lower end just coincides with the zero mark on the internal vertical scale *and* the zero on the barrel scale coincides with the vertical line on the internal scale. Note that the internal scale is graduated every .025" from 0 to 1.00 inch and the barrel scale is graduated in one thousandths from 0 to .025." Turn the meter circuit switch at the top of gage to the "on" position. While holding the barrel at the zero position (and with the gage level), raise or lower the "hook" by turning the top knurled knob (3) until the "hook" or point is above, but near the fluid.

Check to be sure that the meter (1) registers zero. Watch the meter, hold the barrel (4) and lower the hook slowly by turning the top knurled knob (3). As the knob is turned, the point of the "hook" will contact the fluid and the meter pointer will move from zero to some upscale position. After making contact, turn the hook out of the fluid by turning the Micrometer barrel counter-clockwise to a reading of .010 or more. Again watch the meter and, this time, lower the hook by turning the Micrometer barrel. The "hook" position where the meter pointer begins to move up scale is the zero position. This position should correspond to the zero reading on the Micrometer. Adjust the hook in relation to the Micrometer barrel by turning the top knob while holding the barrel steady. Repeat lowering the hook, watching the meter for contact, and adjusting the hook until the zero position and zero reading exactly coincide. The gage is now zeroed and should not be moved.

An alternate method of zeroing and reading can be used wherein, instead of zeroing the gage completely, a zero correction reading is taken and recorded then subtracted from the final read[illegible] Comparable results can be obtained either method.

Positive Pressure Measurement

With the fluid at its proper level, a pressure of 2.0" water column maximum can be measured. Positive pressure should be applied to the top left connection (2) with the Micrometer zeroed as described above. This will permit simple direct readings to be taken.

After an unknown pressure has been applied at the top left connection, the fluid level will drop in the left bore and rise over the "hook" point in the right bore. Note the indicating meter pointer has moved upscale because the "hook" is immersed in the fluid. Turn the Micrometer counter-clockwise until the "hook" point leaves the fluid as indicated by meter pointer dropping to zero on scale. Then slowly turn the Micrometer down until its point or "hook" just touches the fluid surface causing movement of the meter pointer. Withdraw the hook and repeat several times noting each time the Micrometer reading where the meter pointer movement begins. The average of these readings multiplied by two is the pressure applied to the gage. (Avg. reading x 2 = pressure applied in inches w.c.)

When the readings are complete the pressure should be removed and the zero-setting of the Microtector® rechecked. Any change in the zero position will indicate inaccurate readings. Should this happen the zero-set and pressure measurement procedure should be repeated.

BULLETIN NO. H-11

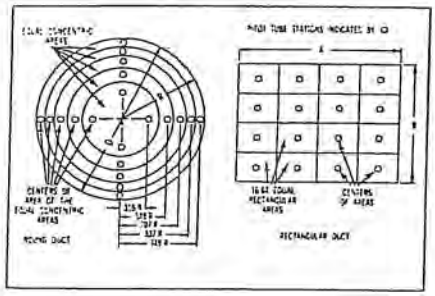
AIR VELOCITIES WITH THE DWYER PITOT TUBE

AIR VELOCITY

The total pressure of an air stream flowing in a duct is the sum of the static or bursting pressure exerted upon the sidewalls of the duct and the impact or velocity pressure of the moving air. Through the use of a pitot tube connected differentially to a manometer, the velocity pressure alone is indicated and the corresponding air velocity determined.

For accuracy of plus or minus 2%, as in laboratory applications, extreme care is required and the following precautions should be observed:

1. Duct diameter 4" or greater.
2. Make an accurate traverse per sketch at right, calculate the velocities and average the readings.
3. Provide smooth, straight duct sections a minimum of 8½ diameters in length upstream and 1½ diameters downstream from the pitot tube.
4. Provide an egg crate type straightener upstream from the pitot tube.



In making an air velocity check select a location as suggested above, connect tubing leads from both pitot tube connections to the manometer and insert in the duct with the tip directed into the air stream. If the manometer shows a minus indication reverse the tubes. With a direct reading manometer, air velocities will now be shown in feet per minute. In other types, the manometer will read velocity pressure in inches of water and the corresponding velocity will be found from the curves in this bulletin. If circumstances do not permit an accurate traverse, center the pitot tube in the duct, determine the center velocity and multiply by a factor of .9 for the approximate average velocity. Field tests run in this manner should be accurate within plus or minus 5%.

The velocity indicated is for dry air at 70°F., 29.9" Barometric Pressure and a resulting density of .075#/cu. ft. For air at a temperature other than 70°F. refer to the curves in this bulletin. For other variations from these conditions, corrections may be based upon the following data:

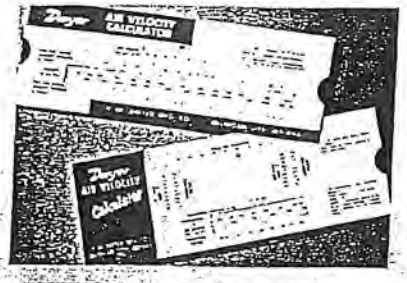
$$\text{Air Velocity} = 1096.2 \sqrt{\frac{Pv}{D}}$$

where Pv = velocity pressure in inches of water
D = Air density in #/cu. ft.

$$\text{Air Density} = 1.325 \times \frac{P_B}{T}$$

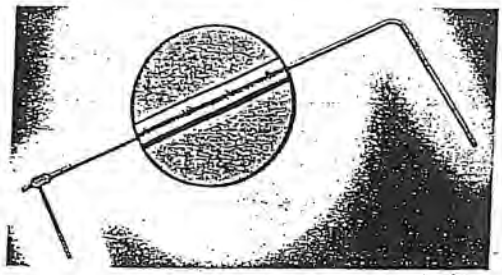
where P_B = Barometric Pressure in inches of mercury
T = Absolute Temperature (indicated temperature °F plus 460)

Flow in cu. ft. per min. = Duct area in square feet x air velocity in ft. per min.



AIR VELOCITY CALCULATOR

Computes velocity based on air density corrected for conditions of temperature and pressure. Eliminates tedious calculations. Ranges from .01 to 10" water corresponding to 400 to 20,000 FPM. Furnished with each pitot tube.



STAINLESS STEEL PITOT TUBES

Test confirmed unity coefficient and lifetime construction of No. 304 stainless steel. Inch graduations show depth of insertion for traversing. Complies with AMCA and ASHRAE specifications. Sizes 12" to 60" long. Hand or fixed mounting types.

LITHOGRAPHED IN U.S.A. 3/84

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2-21 OF 25

Temperature Calibration
EPA Method 28 and 5G

BOOTH:	TEMPERATURE MONITOR TYPE:	IDENTIFICATION NUMBER:
Emissions	OMEGA 115 KF	112

REFERENCE TEMPERATURE MONITOR TYPE:	IDENTIFICATION NUMBER:
OMEGA Calibrator Model CL300 00117	Serial Number 506

CALIBRATION PERFORMED BY:	DATE:	AMBIENT TEMPERATURE:	BAROMETRIC PRESSURE:
KEN MORGAN	11-27-06	63	29.68

Reference Point Source	Temperature Monitor (°F)					
		Method 5G Dilution Tunnel				
OMEGA Thermocouple Simulator Serial #506	Method 28 Room	Meter (Tm)	Filters (Tf)	Tunnel (Tt)	Dryer (Ts)	DB
0	1	1	1	1	1	1
100	98	98	98	98	98	98
300	301	301	301	301	301	301
500	500	500	500	500	500	506
700	699	699	699	699	699	699

Technician signature: K. J. Morg Date: 11-27-06

OMNI Environmental Servic[illegible] Inc.
OMNI-Test Laboratories, Inc.
Beaverton, OR Phone (503) 643-3788

DIFFERENTIAL PRESSURE GAUGE CALIBRATION DATA SHEET
Magnehelic Gauge

Instrument to be calibrated: MAGNAHELIC

Range: 0 - 0.25 ID Number: 126

Calibration Instrument: Digital Manometer ID Number: 315

Date: 12-07-06 By: K. Morgan

Only two data points for a between-calibration check

Digital Manometer (A) (inches of H_20)	Magnehelic Gauge (B) (inches of H_20)	Difference (A - B)	% Error of Full Span*
.251	.248	.003	1.2%
.173	.175	.002	0.8%
.117	.113	.004	1.6%
.030	.028	.002	0.8%

*Acceptable tolerance is 4%.

This calibration is traceable to NIST through the Dwyer Liquid Manometer, NIST Test #MAS 822/254143-94.

Technician signature: K. Morgan Date: 12-07-06

Certificate of Calibration

Certificate # 286629 Page # 1 of 1 Order Date: 13Nov2003

For: OMNI-TEST LABORATORIES

Department: NO PO#: PAM BLACKBURN

56

JJ Calibrations, Inc.

#0723.01

Instrument Identification

Property #: OMNI-00131 Serial #: 27503

Make: OHAUS User:

Model: 500mg

Noun: 500mg WEIGHT

Accuracy: CLASS F

Certification Information

As Found: Within Tolerance Calibration Date: 19Nov2003

As Left: Within Tolerance *Client Specified Due Date: 19Nov2004

Adjustments: None Repairs: None Seals: N/A Environment: 20°C 33% RH

Procedure: CP 16 Technician: 34

Remarks

SEE DATA SHEET FOR MEASUREMENT RESULTS.

*Any number of factors may cause this item to drift out of calibration before the recommended due date has expired.

Standards Used

ID#	Manufacturer	Model#	Nomenclature	Due Date	Trace ID
432	SARTORIUS	C-44	MICROBALANCE 5.1g	19Nov2004	285515

JJ Calibrations, Inc., certifies that this instrument has been compared in accordance with the above referenced procedure using standards with accuracies traceable to the National Institute of Standards and Technology, derived from accepted values of physical constants, derived from ratio measurements, or compared to consensus standards. The results contained herein relate only to the item calibrated. This certificate is in compliance with the applicable requirements of; ISO 17025, ANSI/NCSL Z540-1, MIL-STD-45662A, ISO 10012-1, ISO-9002 and QS-9000.

A Test Accuracy Ratio (TAR) of at least 4:1, if achievable, is maintained unless otherwise stated.

This uncertainty expression is expanded at approximately the 95% confidence level, coverage factor (k=2).

Technical Reviewer

Quality Assurance

This certificate shall not be reproduced except in full, without the written approval of JJ Calibrations, Inc.

Issued 19Nov2003

Rev # 11

7007 SE Lake Rd

JJ Calibrations, Inc.

Manufacturer: Ohaus
Model: 500mg
Nomenclature: 500mg Weight
Serial: 27503

Certificate #: 286629
Date: 19Nov2003
Technician: 34
Calibration Interval: 12 Months

Parameter	Referance Standard	Nominal	UUT Before	UUT After	UUT ± Limit	Uncertainty ±
Mass	N/A	500.00mg	500.11mg		0.72mg	N/A

upplement Data Sheet
old Italics indicates Out of Tolerance Value.

OMNI Environmental Servic(nc.
OMNI-Test Laboratories, Inc.
Beaverton, OR Phone (503) 643-3788

DIFFERENTIAL PRESSURE GAUGE CALIBRATION DATA SHEET
Magnehelic Gauge

Instrument to be calibrated: Liquid Incline Manometer

Range: 0-10" ID Number: 156

Calibration Instrument: Digital Manometer ID Number: 186

Date: 6/4/07 By: John Steinert

Liquid Manometer (A) (inches of H_20)	Magnehelic Gauge (B) (inches of H_20)	Difference (A - B)	% Error of Full Span*
7.5	7.5	0	0
1.5	1.5	0	0
.92	.88	.04	.004
.25	.22	.03	.003

*Acceptable tolerance is 4%.

This calibration is traceable to NIST through the Dwyer Liquid Manometer, NIST Test #MAS 822/254143-94.

Technician signature: [signature] Date: 6/4/07

DELMHORST INSTRUMENT COMPANY
BOONTON, N.J. 07005

5074-578

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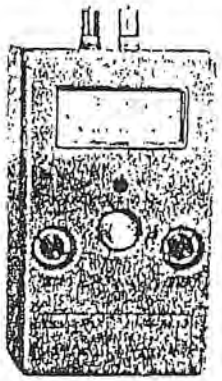
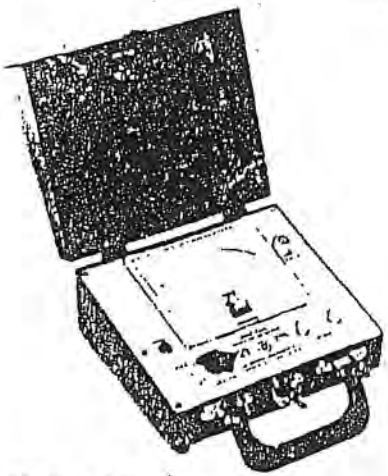
OWNER'S MANUAL



MOISTURE DETECTORS FOR WOOD



DELMHORST INSTRUMENT COMPANY

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MOISTURE DETECTORS

HOW TO MAKE THE BEST USE OF THEM

The Moisture Detector models of the RC, G-2 and J Series (Pocket Tester) are portable, battery powered instruments designed to measure the moisture content in wood. Meters are calibrated so that wood moisture content is read directly on the meter dial. The standard calibration is made on Douglas Fir at a temperature of 70°F.

Contact between meter and wood is made by means of an Electrode.

Electrode(s) should be selected primarily on the basis of wood thickness to be tested.

ACCURACY OF MOISTURE DETECTORS

Moisture Detectors will give most satisfactory service if properly kept, and used in accordance with operating instructions.

The Delmhorst Moisture Meters utilize the principle that a definite relation exists between moisture content and electric resistance in wood. A "resistance" moisture meter actually measures the electric resistance in wood as a function of the moisture content. In order to measure the electric resistance of a board we drive two pins into the wood (or 2 sets of pins in the case of multiple-pins electrode), and have a current flow between them. The higher the moisture content, the lower the resistance. The meter "reads" moisture in that area of the board which is in contact with the electrode pins, and it tends to read the highest moisture content in that area.

Significant differences in moisture content may exist in the same board, especially during drying. Such differences largely depend on the species of the wood and on the range of moisture present in it.

Generally, the lower the moisture content the more uniform is the moisture distribution; the higher the moisture content, greater are the variations in moisture from one point to the other. When the oven test is used for determining the moisture content of a board, the result is the average moisture content of the sample tested, which may or may not be equal to the average moisture content of the rest of the board, because of the differences that frequently occur, especially during the drying process.

On the other hand, if measurements are made with a moisture meter on the same sample, various tests may yield different readings and

even an average of these readings may not agree with the average obtained in the oven test.

Moisture meter readings and oven tests are in closest agreement if moisture content in a board has a very uniform distribution. Since it is well known that distribution of moisture content becomes more uniform at lower moisture range, meter readings may be expected to fall within the following tolerances:

0.5%	on range of	5 – 12%
1.0%	"	12 – 20%
2.0%	"	20 – Saturation point.

AVERAGE MOISTURE CONTENT

When wood is in the process of drying and all of it has been dried below the fibre saturation point, the fibres located at 1/5th of the thickness from the surface have the same moisture content as the average of the section. Therefore, driving the contact pins of the electrode to a depth of 1/5th of the thickness of the wood will indicate a moisture content close to the average of the section.

Tests should be made at least one-foot from the end and 1 inch from the edge and at three diagonal points across the width of the board. The average of the various readings should be the correct answer.

As it has been stated before, the average moisture content as determined by an oven test and the average moisture content as measured by the moisture meter may not agree, unless the wood is well seasoned and has a uniform moisture distribution.

The question often asked is "which one of the two is the more reliable method for accurate measurements"? The two methods are not actually exclusive of each other. Oven tests, properly run by expert personnel with efficient and accurate equipment, are very accurate, but their results can be safely applied only to the specific sample(s) tested. Furthermore, the oven method is not practical if a considerable number of tests are to be made – it is time consuming and is a "destructive" test (in order to obtain a sample, a board has to be cut).

Electric meters' tests are also very accurate, if we consider the moisture content in the area which is in contact with the electrode pins. In addition many "non-destructive" tests can be made in a very short time so that not only an "average" moisture content can be determined, but also variations of moisture are detected.

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When measuring moisture content it is not only important to measure the average but also the range of moisture content. A few high moisture content pieces may have only a small effect on the average moisture content but will result in rejections when associated with wood having a lower average moisture content. Both determinations and their accuracy, must be considered in relation to the ultimate use of the wood. For example, wood to be used indoors will generally attain its equilibium moisture content between 4 and 10% with a usual average of 6 to 7% in most parts of the U.S.A. The amount of variation that can be tolerated depends on the product to be manufactured from it.

Lumber used in the production of fine furniture must not only be dried to an average of 6 to 7% but there must be little difference (usually less than 2%) among the pieces, and between the shell and core.

The meter is calibrated for use with a 4-pin electrode. When using an electrode with two insulated pins slightly lower readings are obtained. A correction of .5% to 1.5% should be added, according to the range of moisture content (See pg. 12).

EFFECT OF WOOD SPECIES ON METER READINGS

Different species of wood have different electrical properties and, as a result read differently for the same moisture content. The Moisture Detector is calibrated so as to read the moisture content of Douglas fir directly. See species corrections table, for other species of wood. The correction below 10% for many species, is so small that it can be disregarded and the meter read directly.

EFFECTS OF TEMPERATURE

As the temperature of wood increases, the electrical resistance decreases and vice-versa. The rate of change is not constant and, for accurate correction factor the temperature correction tables must be consulted. In the range 7 to 12%, the correction is approximately 1% for every 20°, which is subtracted from the meter reading if the temperature of the wood is higher than 70°F. and added if it is lower than 70°F. Most accurate tests are made when the temperature of the wood is approximately the same as the surroundings as it is difficult to measure the temperature of wood whose temperature is changing; as for example, wood just removed from a dry kiln and tested outside.

NUMBER OF MEASUREMENTS

Whatever the method used in measuring moisture content of lumber they are all intended to provide the most accurate information regarding the moisture condition of an entire board. Such accuracy does not only depend on the accuracy of the procedure or of the equipment used, but also on how "representative" the samples are in relation to the load. Theoretically, if one can be certain that all the boards, of a load have the same moisture content, and that the moisture distribution is quite uniform in each board, one meter reading only, or 1 only oven test should be sufficient.

Such "ideal" condition does not occur very frequently. On the contrary, variations do occur in almost every board. If the lumber is properly seasoned the variations are contained within "safe" limits. However, it should be clear that the greater the number of tests the more accurate the final-determination.

The end use of the lumber should indicate how accurate an evaluation of the moisture content is required. For critical use, 5% or even 10% of the load should be tested. It is advisable that a large percentage of pieces be tested when starting to test for moisture. If it is apparent that the lumber is well dried, because of the small difference between readings, the number of tests can be reduced. However, it is important that some tests be made on boards that come from all parts of a load.

SELECTION OF THE ELECTRODE

A standard 4 pin Electrode (Delmhorst Type 4-E) having a 5/16" penetration can be used on most lumber up to 1½" thick. Satisfactory tests can be made with the 4-E Electrode even on wood 2" thick provided the lumber has a low moisture content, normally associated with uniform moisture distribution. Thicker lumber should be tested with electrodes having deeper penetration, such as the Delmhorst Type 26-E and 18-E.

The 26-E has a penetration of 1", the 18-E a penetration of 3". The contact pins of these electrodes are insulated except for approximately 1/8" at their points so that they measure only the moisture of the wood in contact with the uncoated points. These electrodes are generally used for making shell and core tests without cutting the sample.

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Thin wood, such as veneer, is tested by using contact pins with very shallow penetration, such as Delmhorst Type 16-E.

When making tests, contact pins should be driven into sound wood. If poor contact is made the moisture content will be underestimated. Uncoated pins should be driven into the wood to their full length, coated pins to the desired depth.

GRAIN DIRECTION

As the resistance of wood is greater across the grain than with the grain, the electrode should be applied so that current flows parallel to the grain. The effect due to the current flowing across the grain is very small when the moisture content is less than 10% and can be disregarded. At 20% the meter will read about 2% lower when the electrode is placed so that the current flows across the grain.

EFFECTS OF PRESERVATIVES

Organic treatments, such as creosote and pentachlorophenol, have little effect on the accuracy of moisture meter readings. On the other hand, inorganic salts such as zinc chloride and fire retardant compounds electrolize rapidly and affect the readings by indicating a higher moisture content than is actually present.

TESTING PLYWOOD

Most of the animal and vegetable glues have no effect on moisture meter readings. Therefore, when the contact pins penetrate a glue line, if it is dry the moisture content of the wood is accurately measured. In fact, the moisture meter is frequently used to determine when a glue joint is dry.

Many of the resin glues do affect the meter readings because they have a lower electrical resistance than the wood. The effect will be greater at a high moisture content than at a low moisture content.

The moisture meter can be used to show whether or not the glue affects the accuracy of the meter. Drive the contact pins through not more than one half the thickness of the first ply and read the meter.

Then, drive the pins so that they just pass through the first flue line. If there is no appreciable increase in moisture meter reading as the pins make contact with the glue line, the glue may be considered to have no effect and the readings will be correct. The pins should then be driven to their full length and the moisture content read on the meter.

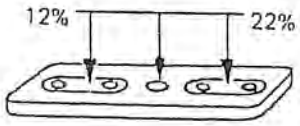
CALIBRATION MOISTURE STANDARDS

Moisture Detectors are accurately calibrated at the factory and they generally hold the calibration indefinitely. If there is doubt as to the accuracy of the Moisture Detector, the calibration is easily checked by use of the Moisture Content Standards which are available for 12% and 22% moisture content.

HOW TO USE MOISTURE STANDARDS

The Moisture Meter (with the electrode not connected to it) should be adjusted in accordance with the operating instructions. After the electrode is connected to the Detector, there should be no appreciable change in the meter reading.

The electrode pins are then applied against the plates on the face of the standard: one pin to the center point, the other pin to one of the plates. The meter is considered to be in calibration if the reading is within one half of 1 percent of the standard (12% or 22%).



TESTS ON LUMBER THAT IS WET ON THE SURFACE

Lumber exposed to rain, fog or high relative humidity, is likely to have a higher surface moisture than the core. When the surface moisture is only a very thin film, it will dissipate quickly, without affecting the soundness of the lumber.

However, if it must be tested when surface moisture is present, insulated pins should be used (Electrode 26E with #496 pins).

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DECAY OF WOOD

When wood has a moisture content in excess of 20% and is exposed to air it will support fungus growth, cause of decay and rot. The Delmhorst Moisture Detector is very useful in determining whether or not a wood structure or part thereof is subject to decay while it is still in good condition. For instance, a joint between two wood members may collect storm water and hold it there for considerable periods of time, thus causing decay. The Delmhorst Moisture Detector will reveal this condition and show that treated wood should be used or some metal protection or waterproofing be provided to prevent the retention of water in joints of this nature.

READINGS ABOVE FIBER SATURATION POINT

The meter scale features readings above 30%, (fiber saturation point). They are marked in green to indicate that the lumber still has free water, and should not be taken as an accurate, quantitative measurement of the moisture content. They lag far behind the actual moisture content and should only be used for the following purposes:

1. to indicate that the wood still has free water,
2. to allow dry kiln operators to make "Hot" board readings as the boards are removed from the kiln, when the temperature effect causes the meter readings to rise.

A reading of 40% on a board with a temperature of 160°F. indicates that, after the appropriate temperature correction is applied, the actual moisture content is 24%, which is a reliable indication, since the moisture content is below fiber saturation point.

TESTING WOOD FLOORING AND SUB-FLOORING

Moisture detectors are indispensable for the proper installation of wood flooring. For best results wood should have, at the time of installation, a moisture content close to the average between the high and low moisture content value it will attain in use. If wood is too wet when it is put in place, it will eventually dry to a moisture content in equilibrium with the environment conditions of prevailing relative humidity. The drying will obviously result in shrinkage, and cracks will develop.

On the other hand, if flooring with a very low moisture content were laid in an area when high relative humidity prevails, it will pick up

moisture and swell. The recommended moisture content for wood flooring as follows (based on information shown in Forest Products Laboratory Bulletin No. 1055 entitled "Moisture Content of Wood in Use");

	Average	Indiv. Pieces
Dry Southwestern States	6%	5-8%
Damp Southern Coastal States	10%	9-12%
Remainder of the United States	7%	6-9%

When flooring is installed on concrete slabs, it is important that the concrete be thoroughly dry at the time of installation. If it is not, the floor will pick up moisture from the slab and, even though it had the recommended moisture content at the time of installation, will absorb the moisture which will result in "compression set" which will be followed by shrinkage when the wood finally dries to the normal moisture content.

MAINTENANCE OF MOISTURE DETECTOR

Your Delmhorst Moisture Detector is a fine quality precision instrument. Given reasonably good care it will last indefinitely with only an occasional replacement of batteries.

When it is necessary to replace the batteries, the screws holding the panel in the case must be removed in order to remove the panel. In more recent models, the battery compartment is easily accessible through its own door or cover, thus eliminating the need to remove the panel.

THE EFFECT OF HIGH RELATIVE HUMIDITY

If a moisture detector is used in areas of high relative humidity, moisture may set on some of the components or on parts of the electrode, creating an electrical leakage. This will cause the meter to "read" as soon as it is turned on. In such areas, the instrument should be stored in a dry office or warehouse, when not in use. If a dry office is not available, it may be stored in a small closed cabinet, heated with a 40-watt bulb. This will raise the temperature sufficiently to lower the level of humidity in the cabinet. Normally, moisture by condensation will collect on the meter or on the electrode and it will affect the meter readings when the instrument is brought from a cool storage area into a warm, humid environment. For this reason, operating a moisture meter inside a kiln is a practice to be discouraged.

Following are some comments concerning the possible malfunctions:

1. The meter cannot be adjusted.
   In such case, the batteries are usually weak or they are not making good contacts with battery terminals in the holders.
2. The meter pointer moves to the right as soon as the meter is turned on, even though the electrode is not in contact with any material.
   This is due to a current leakage, generally caused by dirt or moisture between the two poles of the electrode. The electrode insulation should be cleaned.
3. The meter gives no readings after the pins are driven into the wood and the meter is turned on.
   This is normally due to a broken wire in the electrode cable. The Moisture Detector and its electrode are in good working order if, upon placing the fingers across the contact pins, the meter reads between 20 and 30. If it had been possible to adjust the meter according to instructions, a failure to obtain a reading when touching the contact pins would indicate that the trouble is in the electrode and not in the instrument.
4. Whenever it appears necessary that a panel meter or a vacuum tube is to be replaced, the instrument should be returned to the factory for repair.
5. Such Models as the J-1, J-2, and RC-1C and RC-2, feature printed circuits on boards which can be easily unplugged and returned to the factory for repair, replacement or recalibration.

USING THE MOISTURE METER ON MATERIAL OTHER THAN WOOD

It is possible that the moisture detectors may find a useful application to indicate the moisture content of material other than wood. In such cases, after an initial evaluation, a calibration should be developed for the material in question. Ask for Bulletin "Procedure for Moisture Meter Calibration", PIB #87.

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TYPE 26E ELECTRODE

The 26E electrode is an original Delmhorst design for
- non-destructive shell and core tests,
- detection of moisture gradient,
- testing lumber with wet surface.

The contact pins of this electrode are insulated except for the tip so that the depth at which measurements are taken is clearly identified.

Readings taken with the 26E electrode are slightly lower than those taken with the 4-pin (4E) electrode which is used in the basic calibration of the instrument.

When using the 26E Electrode with insulated pins, the meter readings should be corrected according to the following table:

26E

Meter Reading									
7	8	10	12	14	16	18	20	22	24
Correct Reading									
7.3	8.4	10.6	12.8	14.9	17.0	19.2	21.4	23.7	26.0

The above correction should be disregarded when the insulation of the pins has worn off, or the uninsulated pins (A-111) are used.

4E

TYPE 4E – To test boards, ¼" to 1½" thick. Pins penetration is 5/16". A hammer extractor for driving and extracting pins from lumber is available as optional equipment. Weight 2½ lbs.

4E-H

TYPE 4E-H – Hammer style version of the 4E. To be used on softwoods only. Excellent for measuring moisture content on "dry chain". Weight 1½ lbs.

TYPE 18E – Similar to the 26E electrode. Pins penetration up to 3¼". Weight 2½ lbs.

TYPE 15E – Eight-pin electrode for veneer. Pins penetration is 1/8". Electrode can be used for checking veneer m.c. at end of dryer, at time of gluing and for incoming inspection. Weight ½ lb.

15E

BATTERIES USED IN VARIOUS DELMHORST MOISTURE DETECTORS

INSTRUMENT MODEL	NO. BATTERIES	BATTERY TYPES	
RC-1	3	1.5V "D" Flashlight Eveready	#950
	4	22.5V Burgess K-15 or Eveready	#420
RC-1B with Serial Nos. up to #6444			
	1	1.5V "D" Fleshlight Eveready	#950
	4	22.5V Burgess Y-15 or Eveready	#505
RC-1B with Serial Nos. 6445 to #6699			
	1	1.5V Alkaline Energizer Ever.	#E-91
	4	22.5V Burgess Y-15 or Eveready	#505
RC-1B with Serial Nos. 6700 & up			
	1	1.5V Alk. Energizer Eveready	#E-91
	3	22.5V Burgess Y-15 or Eveready	#505
RC-1C	3	9V Eveready	#216
RC-2	2	9V Eveready	#216
G-2	1	45V Eveready	#455
	1	1.5V "D" Flashlight Eveready	#950
G-2B	1	1.5V "D" Flashlight Eveready	#950
	2	22.5V Burgess Y-15 or Eveready	#505
G-2C & G-2D	1	1.5V Alk. Energizer Eveready	#E-91
	1	22.5V Burgess Y-15 or Eveready	#505
G-2E/G-22	2	9V Eveready	#216
J & J (A)	1	1.5V Alk. Energizer Eveready	#E-91
	1	22.5V Burgess Y-15 or Eveready	#505
J-1 & J-2	2	9V Eveready	#216

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OTHER INSTRUMENTS AVAILABLE

Electronic
THERMOMETER
Model TM-2

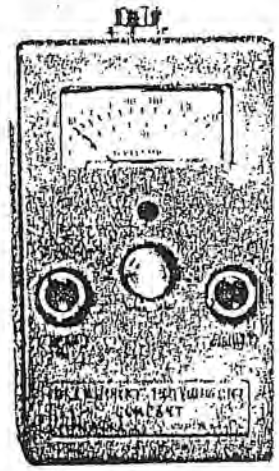
The TM-2 is a solid-state, portable battery operated instrument.

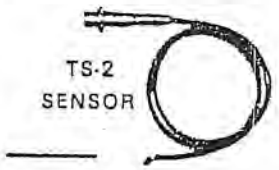
Remote sensing is possible up to 1000' or more. Probe extensions available in 3' rigid sections.

RANGES

TM-2 (30°-150°F / 0-66°C.)
TM-3 (−20°-110°F)
TM-4 (100°-250°F)
TM-5 (−20°-200°F)

The TS-2 Sensor is used to measure the temperature of liquids, gases or solids.





TS-2
SENSOR

THE DELMHORST KIL-MO-TROL

The kiln keeps operating — you stay outside and measure moisture content of lumber while it is drying. There is no need to enter a hot kiln or to shut it down.

Saves Lumber — No need for sample boards. Tests are made on the lumber in the charge.

Saves Time — Shows exactly when lumber is dry.

Saves Labor — Twenty moisture tests, shell and core, in all parts of the charge can be made in less than two minutes.

Send sketch showing your kilns and control panel for a free Kil-Mo-Trol layout and cost of installation.

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Appendix 2

MOISTURE CONTENT SCALES

There are two common ways of reporting moisture content in wood. In this book, and in most technical writings, moisture content is always based upon the ovendry weight of the wood:

$$\text{Moisture content (ovendry wood basis)} = \frac{\text{weight of moisture removed in oven drying}}{\text{weight of ovendry wood}}$$

Using this scale, wood which is half water by weight has a moisture content of 100 percent.

A second way to report moisture contents is based on the weight of the moist wood:

$$\text{Moisture content (moist wood basis)} = \frac{\text{weight of moisture removed in oven drying}}{\text{initial weight of wood, including its moisture}}$$

Using this scale, wood which is half water by weight has a moisture content of 50 percent.

These different scales for reporting moisture contents are another possible cause for discrepancies among lists of energy contents. 20 percent moisture content on an ovendry wood basis is the same as 25 percent moisture content on a moist wood basis. To facilitate comparisons between writings using the two conventions, Table A2-1 gives conversions.

MOISTURE CONTENT ON AN OVENDRY-WOOD BASIS PERCENT	MOISTURE CONTENT IN EITHER SCALE PERCENT	MOISTURE CONTENT ON A MOIST-WOOD BASIS PERCENT
0%	0%	0%
5.3	5	4.8
11.1	10	9.1
17.6	15	13.0
25.0	20	16.7
33.3	25	20.0
42.9	30	23.1
53.8	35	25.9
66.7	40	28.6
100.0	50	33.3
150.0	60	37.5
233.0	70	41.2
Infinite	100	50.0
--	150	60.0
--	200	66.7
--	250	71.4

TABLE A2-1. Conversions between moisture contents as expressed in the moist wood and oven-dry wood scales. To use the table for either conversion, find the value to be converted in the center column. Then to convert from dry to moist basis read to adjacent number in the right column. To convert from moist to dry, read the adjacent number in the left column. If m and d represent the moisture contents on the moist-wood and dry-wood bases respectively, then m = d/1 + d), and d = m/(1-m).

HV: BRUCE DAVIS

Weigh-Tronix, Inc.
7933 SW Nimbus Ave. #28
Beaverton, OR 97005
503-626-3008
1-800-878-3008

WEIGH-TRONIX

SERVICE WORK ORDER

SHIP TO
NAME OMNI ENVIRONMENTAL SERVICES
ADDRESS 5465 SW WESTERN AVE
CITY BEAVERTON
PHONE 503 - 643-3788 STATE OR ZIP 97075
FAX
CONTACT Bruce or Richard

JOB No. 111991
CUSTOMER No.
Order Date / /
Start Date / /
Complete Date 1 / 11 / 99

BILL TO
NAME
ADDRESS PO BOX 743
CITY
ATTN: STATE ZIP

P.O. No. 99-007

EQUIPMENT:

S/N	Location	Type	Cap.	Recommendations and Remarks
5507		WI-127	1K	10,000 DIV
21676		3030	1K	

COMMENTS:

Rental 1 Month

Set up calibrated 1000 ± 0.1 LB pos. codes tested. good.

PARTS:

2.5

Qty.	Description	Price	Total

INE _____ VEHICLE _____
ECHNICIAN LD

SERVICE SUMMARY

Reg.	Agree.	Pref.	Inst.
	Hrs. @		
	Mileage		
	Parts		
	Shop Supplies		
	Other		
	TOTAL		

THIS IS NOT AN INVOICE

I acknowledge all service has been performed satisfactorily, as stated above. All parts installed are warranted for thirty days from this date.

Authorized Signature Bruce Davis

Print Name Bruce Davis

WEIGH-TRONIX
Rental / Sales / Service

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OMNI 00209

Instruction Booklet

for use with

PRINCO

Fortin type mercurial

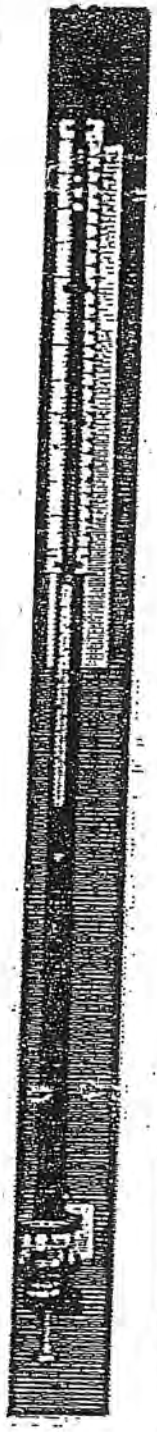
Barometers

453
National
Weather
Service
Type

Manufactured by

PRINCO INSTRUMENTS, INC.
1020 Industrial Blvd.
Southampton, Pa. 18966-4095
U.S.A.

Phone: 215 355-1500
Fax: 215 355-7766



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NOVA™
Economy
Model

2-37 OF 2-53

Certificate of Calibration

Certificate # **283508** Page # 1 of 1 Order Date: 09Oct2003

For: OMNI-TEST LABORATORIES 56

Department: NO PO#: OTL-03-093

JJ Calibrations, Inc.

#0723.01

Instrument Identification

Property #: OMNI 00255 Serial #: OMNI00255

Make: UNKNOWN User:

Model: 10 lb

Noun: WEIGHT

Accuracy: RAW DATA

Certification Information

As Found: Other - See Comments Calibration Date: 13Oct2003

As Left: Return As Is *Client Specified Due Date: 13Oct2004

Adjustments: None Repairs: None Seals: N/A Environment: 21°C 38% RH

Procedure: CP 16 Technician: 54

Remarks

SEE DATA SHEET FOR MEASUREMENT RESULTS.

*Any number of factors may cause this item to drift out of calibration before the recommended due date has expired.

Standards Used

ID#	Manufacturer	Model#	Nomenclature	Due Date	Trace ID
550	AND (A&D) CO.	HP-30K	30k GRAM BALANCE	12Feb2004	267090

JJ Calibrations, Inc., certifies that this instrument has been compared in accordance with the above referenced procedure using standards with accuracies traceable to the National Institute of Standards and Technology, derived from accepted values of physical constants, derived from ratio measurements, or compared to consensus standards. The results contained herein relate only to the item calibrated. This certificate is in compliance with the applicable requirements of; ISO 17025, ANSI/NCSL Z540-1, MIL-STD-45662A, ISO 10012-1, ISO-9002 and QS-9000. A Test Accuracy Ratio (TAR) of at least 4:1, if achievable, is maintained unless otherwise stated. This uncertainty expression is expanded at approximately the 95% confidence level, coverage factor (k=2).

Technical Reviewer

Quality Assurance

This certificate shall not be reproduced except in full, without the written approval of JJ Calibrations, Inc.

Issued 13Oct2003

Rev # 11

7007 SE Lake Rd. • Portland, OR 97267-2105 • Telephone (503) 786-3005 • Fax (503) 786-2994 • www.jjcalibrations.com

JJ Calibrations, Inc.

Manufacturer: Unknown
Model: 10 lbs.
Nomenclature: Weight
Serial: OMNI00255

Certificate #: 283508
Date: 13Oct2003
Technician: 54
Calibration Interval: 12 Months

Parameter		Nominal	UUT Before	UUT After	UUT ± Limit	Uncertainty ±
Weight Accuracy	N/A	10 lbs	10.0015lbs		N/A	N/A

Supplement Data Sheet
Bold Italics indicates Out of Tolerance Value.

Certificate of Calibration 365375

Omni-Test Laboratories
5465 SW Western
Suite G
Beaverton, OR 97005

Cust ID: 56

PO: OTL-07-184
Authorized By:

JJ Calibrations, Inc.

ACCREDITED
0723.01

Make: Omega
Model: RH82
Noun: THERMO HYGROMETER
Serial #: 9190156
Property #: OMNI-00291
Department: NO
User:
Procedure: CP 11
Accuracy: REFER TO SPECIFICATIONS

Order Date: 02/01/2007
Calibrated on: 02/04/2007
*Recommended Due: 02/04/2008
Environment: 23°C 40%RH
As Received: Within Tolerance
As Returned: Within Tolerance
Action Taken: Calibrated
Technician: 40
ID Barcode: FNLB

Remarks
Refer to attachment for measurement results.

* Any number of factors may cause the calibration item to drift out of calibration before the recommended interval has expired

Standards Used

Std ID	Manufacturer	Model	Nomenclature	Due Date	Trace ID
429A	Rosemount	162CE	SPRT	05/26/2008	345339
464A	General Eastern	M4-RH/D2	HUMIDITY STANDARD	12/29/2007	363083
582A	Fluke	8508A	8 1/2 Reference Mtr	05/31/2007	348323

This instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual and is traceable to the National Institute of Standards and Technology (NIST). The quality system and this certificate are in compliance with ANSI/NCSL Z540-1-1994, ISO/IEC 17025-1999, ISO 10012-1, the ISO 9000 family and QS 9000. The expanded uncertainties of measurements for this calibration are based upon 95% (2 sigma) confidence limits. The results reported herein apply only to the calibration of the item described above. This report may not be reproduced, except in full, without written approval of JJ Calibrations.

Reviewer

Inspector

5 Issued 02/05/2007 Rev # 12

7007 SE Lake Rd Portland, OR 97267-2105 Phone 503.786.3005 FAX 503.786.2994 www.jjcalibrations.com

JJ Calibrations, Inc.

Manufacturer: Omega
Model: RH82
Nomenclature: Temp/Humidity Meter
Serial: 9190156

Certificate #: 365375
Date: 04Feb2007
Technician: 40
Calibration interval: 12Months

Parameter		Reference Standard	UUT Before	UUT After	UUT ± Limit	Uncertainty ±
Humidity Accuracy		30.0%	28.3%	28.3%	3.0%	0.67%
		70.1%	68.8%	68.8%	3.0%	1.23%
Temperature	Ambient	20.01°C	19.4°C	19.4°C	1.0°C	0.01°C
Accuracy						

Supplement Data Sheet
Bold Italics indicates Out of Tolerance Value.

OMNI Environmental, Inc.
OMNI-Test Laboratories, Inc.
Beaverton, OR (503) 643-3788

NIST Stopwatch Calibration, Time Proficiency Testing Procedure and Data Sheet

Date: 10/10/06 User/Technician: B Davis ☒ Pass ☐ Fail

NIST traceable stop watch OMNI Tracking Number: 292 Last Cal: 2-7-06

Stopwatch to be tested for time proficiency OMNI Tracking Number: 300

1. Start the NIST traceable stopwatch; at a predetermined time (i.e., 1.00 minutes), the technician shall start the watch being tested. When 15.00 seconds have passed (i.e., the NIST traceable stopwatch reads 1 minute, 15 seconds), the technician shall stop the watch being tested. Record the target time interval (i.e., 15.00 seconds). Repeat this step twice and record the data.

2. Repeat step #1 for each of the following target time intervals: 30.00 seconds, 10.00 minutes, and 30 minutes.

3. If the delta between the target time and measured time is less than 5% of the target time interval or 2.00 seconds (whichever is less), then the technician has demonstrated proficiency with the specific instrument utilized in the proficiency test. The proficiency is valid for a period of twelve months.

4. Archive the proficiency test data and information, including the effective date and expiration date of the proficiency, in the equipment record for the instrument involved.

Target time: 15.00 seconds #1 Measured time: 15.09 #2 Measured time: 15.13 #3 Measured time: 15.00

Target time: 30.00 seconds #1 Measured time: 30.07 #2 Measured time: 30.03 #3 Measured time: 29.97

Target time: 10.00 minutes #1 Measured time: 10.00.04 #2 Measured time: 10.00.10 #3 Measured time: 9:59.53

Target time: 30.00 minutes #1 Measured time: 30:00 #2 Measured time: 30.00 #3 Measured time: 30.00

Technician Signature: _____ Date: 10-11-06

Thermal Metering System Calibration
Y and dH@

Manufacturer:	APEX
Model:	563
Serial Number:	NA
OMNI Tracking No.:	322

Average Orifice Meter dH@	Average Gas Meter y Factor
1.926	0.980

Calibration Date:	11/05/07
Calibrated by:	B. Davis
Calibration Frequency:	6100 Series Post Test
Next Calibration Due:	05/05/08
Instrument Range:	1.000 cfm
Standard Temp.:	68 oF
Standard Press.:	29.92 "Hg
Barometric Press.:	30.05 "Hg
Signature/Date:	B.D 11-5-07

Previous Calibration Comparision

Date	10/12/2007	Acceptable	
dH@ Value	NA	Deviation (5%)	Deviation
y Factor	0.983	0.04915	0.003
Acceptance	Acceptable		

Current Calibration

Acceptable y Deviation	0.020
Maximum y Deviation	0.000
Acceptable dH@ Deviation	0.200
Maximum dH@ Deviation	0.014
Acceptance	Acceptable

Reference Standard *			
Standard Calibrator	Model	Standard Test Meter	
	S/N	00141	
	Calib. Date	03-May-07	
	Calib. Value	0.9980	y factor (ref)

Calibration Parameters	Run 1	Run 2	Run 3
Vacuum ("Hg)	0.00	0.00	0.00
dH ("H2O)	0.90	0.90	0.90
Initial Reference Meter	990.6	996.732	1003.335
Final Reference Meter	996.732	1003.335	1011.477
Initial DGM	0	0	0
Final DGM	6.202	6.706	8.32
Temp. Ref. Meter (°F), Tr	63.0	65.0	65.0
Temperature DGM (°F), Td	61.0	65.0	68.0
Time (Minutes)	12.0	13.0	16.0
Net Volume Ref. Meter, Vr	6.132	6.603	8.142
Net Volume DGM, Vd	6.202	6.706	8.32
Gas Meter y Factor =	**0.981**	**0.981**	**0.980**
Gas Meter y Factor Deviation (from avg.)	0.000	0.000	0.000
Orifice dH@	**1.92**	**1.94**	**1.92**
Orifice dH@ Deviation (from avg.)	0.009	0.014	0.004

where:

1. Deviation = |Average value for all runs - current run value|
2. y = [Vr x (y factor (ref)) x (Pb) x (Td + 460) / [Vd x (Pb + (dH / 13.6)) x (Tr + 460]
3. dH@ = 0.0317 x dH / (Pb (Td + 460)) x [(Tr + 460) x time) / Vr]^2

* Reference calibration is traceable to NIST through NIST Test # 40674, Kimble ASTM E1272

Example Calculations

Note: OMNI uses the Lotus 1-2-3 computer program for all Method 5G and 5H calculations. The program automatically carries 14 decimal points in all calculations. The numbers on the printouts have been rounded for display only.

Equations and Sample Calculations - Method 5G

Equations used to calculate the parameters listed below are described in this appendix. Sample calculations are provided for each equation. The raw data and printout results from a sample run are also provided for comparison to the sample calculations.

BR	Dry burn rate, kg/hr
m_n	Total particulate matter collected, mg
$V_{m(std)}$	Volume of gas sampled corrected to standard conditions, dscf
v_s	Average dilution tunnel gas velocity, ft/sec
C_s	Particulate concentration, g/dscf
Q_{sd}	Average dilution tunnel gas flow rate, dscf/min
E	Particulate emission rate, lbs/hr
PR	Proportional rate variation, %

Dry Burn Rate

Using equation 28-3:

$$BR = \frac{60 \times W_{wd}}{\theta} \times \frac{100 - \%M_w}{100}$$

Where,

BR	=	Dry burn rate, lb/hr
W_{wd}	=	Mass of wood burned (wet basis) during test run, lb
θ	=	Total time of test run, minutes
$\%M_w$	=	Average moisture content of test fuel charge, wet basis percent

Sample Calculation:

Dry basis moisture of fuel = 20.03%

Using the equation 28-2 for converting dry basis moisture to wet basis moisture,

$$\%M_w = \frac{20.03 \times 100}{20.03 + 100}$$

$$\%M_w = 16.69\%$$

The wet weight of the fuel charge was 7.8 pounds. Converting pounds to kilograms yields a weight of 3.538 kg. The run time for this run was 180 minutes. Therefore, the burn rate equation appears thus:

$$BR = \frac{60 \times 3.538 \times (100 - 16.69)}{180 \times 100}$$

$$BR = 0.98\ kg/hr = 2.17\ lb/hr$$

Total Particulate Matter Collected

$$m_n = F_1 + F_2 + R - (V_a \times B_a)$$

Where:

m_n	=	Total particulate matter collected, mg
F_1	=	Particulate matter collected on front filter, mg
F_2	=	Particulate matter collected on rear filter, mg
R	=	Residue from evaporated probe and filter holder acetone rinse, mg
V_a	=	Volume of acetone evaporated probe and filter holder actone rinse, ml
B_a	=	Acetone blank value, mg/ml

Sample Calculation:

$m_n = 12.6 - 0.4 + 4.7 - (180 \quad 0.0040)$

$m_n = 16.2$ mg

Volume of Gas Sampled Corrected to Dry Standard Conditions

Using equation 5-1:

$$V_{m(std)} = V_m \times Y \times \left(\frac{T_{std}}{P_{std}}\right) \times \frac{\left(P_b + \frac{\Delta H}{13.6}\right)}{T_m}$$

Where:

K	=	17.64 °R/in. Hg
T_{std}	=	528 °R
P_{std}	=	29.92 in. Hg
V_m	=	Volume of gas sample measured at the dry gas meter, dcf
Y	=	Dry gas meter calibration factor, dimensionless
P_b	=	Barometric pressure at the testing site, in. Hg
ΔH	=	Average pressure differential across the orifice meter, in. H_2O
T_m	=	Absolute average dry gas meter temperature, °R

Sample Calculation:

$$V_{m(std)} = 98.434 \times 1.01 \times \left(\frac{528}{29.92}\right) \times \frac{30.03 + \frac{0.7}{13.6}}{532.5}$$

$$V_{m(std)} = 99.116\ ft^3$$

Dilution Tunnel Gas Velocity

Using equations 2-7 and 2-6, calculated at each recorded interval:

$$v_s = k_p \times C_p \times \sqrt{\Delta P} \times \sqrt{\frac{T_{s(avg)}}{P_s \times M_s}}$$

$$M_s = M_d \times (1 - B_{ws}) + 18.0 \times B_{ws}$$

Where:

v_s = Average dilution tunnel gas velocity, ft/sec

k_p = Pitot tube constant: $85.49 \frac{ft}{sec} \left[\frac{(lb/lb\text{-}mole) \times (inches\ Hg)}{(^oR) \times (inches\ H_2O)}\right]^{\frac{1}{2}}$

C_p = Pitot tube coefficient (0.99 for standard pitot tube; 0.84 may be used for S-type pitot tubes constructed according to Method 2 procedures), unitless

ΔP = ΔP measured during the pre-test flow traverse of the dilution tunnel; the square root of the ΔP values are averaged for this calculation, in. H_2O

P_b = Barometric pressure at test site, in. Hg

P_g = Static Pressure of tunnel, in. Hg

P_s = Absolute tunnel pressure, = $P_b + P_g$

M_s = Molecular weight of tunnel gas; assume M_d =29 lb/lb-mole (per method 5G)

B_{ws} = Moisture content of dilution tunnel gas, ratio; assume 4% (per method 5G)

T_s = Dilution tunnel temperature, °R; (°R = °F + 460)

Sample calculation:

$$M_s = 29 \times (1 - 0.04) + 18.0 \times 0.04 = 28.56$$

$$v_s = 85.49 \times 0.99 \times \sqrt{0.0351} \times \sqrt{\frac{(548)}{(30.03 + \frac{-0.45}{13.6}) \times (28.56)}}$$

$$v_s = 12.69 \frac{ft}{sec}$$

Particulate Concentration

Using equation 5G-2:

$$C_s = 0.001 \frac{g}{mg} \times \frac{m_n}{V_{m(std)}}$$

Where:

C_s	=	Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscf
m_n	=	Total mass of particulate matter collected in the sampling train, mg
$V_{m(std)}$	=	Volume of gas sampled corrected to dry standard conditions, dscf

Sample calculation:

$$C_s = \frac{0.001 \times 16.2}{99.116}$$

$$C_s = 0.000163 \ g/dscf$$

Average Dilution Tunnel Gas Flow Rate

Using equation 2-8, calculated at each recorded interval:

$$Q_{sd} = 3600 \times (1 - B_{ws}) \times v_s \times A \times \frac{T_{std}}{T_{s(avg)}} \times \frac{P_s}{P_{std}}$$

Where:

Q_{sd}	=	Gas flow rate corrected to dry, standard conditions, dscf/hr
3600	=	Conversion from seconds to hours
B_{ws}	=	Moisture content of dilution tunnel gas, ratio; assume 4% (per method 5G)
v_s	=	Average dilution tunnel gas velocity, ft/sec
A	=	Cross sectional area of dilution tunnel, ft^2
T_{std}	=	Standard absolute temperature, 538°R
$T_{s(avg)}$	=	Average absolute dilution tunnel temperature, °R, (°R = °F + 460)
P_b	=	Barometric pressure at test site, in. Hg
P_g	=	Dilution tunnel static pressure, in. Hg
P_s	=	Absolute dilution tunnel gas pressure, in Hg, (Hg = $P_b + P_g$)
P_{std}	=	Standard absolute pressure, 29.92 in Hg

Sample calculation:

$$Q_{sd} = 3600 \times (1 - 0.04) \times 12.69 \times \frac{(\pi \times 3^2)}{144} \times \frac{528}{548} \times \frac{30.03 + \frac{-0.45}{13.6}}{29.92}$$

$$Q_{sd} = 8313.36\ dscf/hr = 138.56\ dscf/min$$

Particulate Emission Rate

Using equation 5G-3 and 5G-4:

$$E = C_s \times Q_{sd}$$

$$E_{adj} = K_3 \times E^{0.83}$$

Where:

E	=	Particulate emission rate, g/hr
E_{adj}	=	Particulate emission rate, adjusted, g/hr
C_s	=	Concentration of particulate matter in the stack, corrected to dry, standard conditions, g/dscf
Q_{sd}	=	Average dilution tunnel gas flow rate, dscf/hr
K_3	=	Constant, 1.82 for metric units, 0.643 for English units

Sample calculation:

$$E = 0.000163 \times 8313.36 \times 60$$

$$E = 1.36\ g/hr$$

$$E_{adj} = 1.82 \times 1.36^{0.83}$$

$$E = 2.35\ g/hr$$

Proportional Rate Variation

Using equation 5H-9, calculated at each recorded interval:

$$PR = \frac{\theta \times (V_{mi} \times V_s \times T_m \times T_{si})}{10 \times (V_m \times V_{si} \times T_s \times T_{mi})} \times 100$$

Where:

PR	=	Percent proportional rate
θ	=	Time of test, min
S_i	=	Measured tracer gas concentration for the "i^{th}" interval, in this case, the inverse of the calculated flow in the stack based on CO_2 concentrations in the stack and in the dilution tunnel
$V_{mi(std)}$	=	Volume of gas sample measured by the dry gas meter during the "i^{th}" 10 minute interval, dscf
V_m	=	Volume of gas sample as measured by dry gas meter, dscf
V_{si}	=	Average gas velocity in the dilution tunnel during each 10 minute interval, i, of the test run, m/sec
V_s	=	Average gas velocity in the dilution tunnel, m/sec
T_{mi}	=	Absolute average dry gas meter temperature during each 10 minute interval, i, of the test run, °R
T_m	=	Absolute average dry gas meter temperature, °R
T_{si}	=	Absolute average gas temperature in the dilution tunnel during each 10 minute interval, i, of the test run, °R
T_s	=	Absolute average gas temperature in the dilution tunnel, °R

Sample calculation (for the reading at 50 minutes into test run 1):

$$PR = \frac{180 \times 5.6 \times 12.69 \times 533 \times 552}{10 \times 98.434 \times 12.63 \times 548 \times 532} \times 100$$

$$PR = 103.8\%$$

Section 3

Owner's Manuals

By appointment to The Royal Danish Court

morsø

Installation and Operating Instructions

6100 series

For use in North America

Read this entire manual before you install and use your new room heater. If this room heater is not properly installed, a house fire may result. To reduce the risk of fire, follow the installation instructions. Failure to follow instructions may result in property damage, bodily injury, or even death.

Contact local building officials about restrictions and installation/inspection-requirements in your area.

Save these instructions

MORSØ JERNSTØBERI A/S . DK-7900 NYKØBING MORS
E-Mail: stoves@morsoe.com · Website: www.morsoe.com

Distributed by: MORSO US LLC
1011 Highway 52 West - Portland TN - 37148 - USA

We congratulate you on your choice of a Morsø stove. Morsø has been producing some of the world's best stoves since 1853. If you follow this installation- and operating instruction carefully, we can assure you many years of warmth and pleasure.

Optional Accessories
A wide range of accessories (such as handling gloves, fireside tools, glass cleaner and heatproof paint) are available for use with your Morsø stove. They help with day-to-day running and maintenance. Contact your Morsø dealer for more information.

The Morsø 6100 series meets the U.S. Environmental Protection Agency's emission limits for wood heaters sold on or after July 1, 1990

The Morsø 6100 series have been tested by OMNI-Test Laboratories, Inc. The test standards are ANSI/UL-1482 for the United States and ULC S627 for Canada.

The stove is listed for burning wood only. Do not burn other fuels.

Under specific test conditions this heater has been shown to deliver heat at rates ranging from xx,xxx to xx,xxx Btu's.

NATIONAL FIREPLACE INSTITUTE NFI CERTIFIED www.nficertified.org

We recommend that our pellet hearth products be installed and serviced by professionals who are certified in the U.S. by the National Fireplace Institute® (NFI) as NFI Pellet Specialists or who are certified in Canada by Wood Energy Technical Training (WETT).

Wood Energy Technical Training

CONTENTS:

1.0 Installation of your Morsø stove

Installation of woodburning stoves must be safe and legal.

If your Morsø stove is not installed correctly, it may cause a house fire. To reduce the risk of fire, the installation instructions must be followed carefully. Contact the local building officials about restrictions and installation inspection in your area.

Before you start installing your stove, make sure that:

- The stove and chimney connection are placed far enough from combustible materials to meet all clearance requirements.
- The floor protection must be adequate and must be made correctly according to the requirements.

All neccessary approvals are needed from the local building officials.

The data plate, which is located on the back of the stove, provides information regarding safety testing information, name of certified testing laboratory, and installation requirements.

Installation requirements vary in different districts, and the local building officials have the final authorization to approve your installation. You should discuss the installation with them before beginning. Please ask your dealer for further information.

Do not connect to any air distribution duct or system.

Important: If the installation instructions are not followed carefully, it may cause dangerous situations like chimney - and house fires. Follow the instructions carefully and do not deviate from them as it may cause injuries to people or property.

1.1 Checking loose parts in the stove

After unpacking, check that the fire bricks are firmly in position and have not shifted in transit. Check also that the air control works freely.

Before starting the initial fire, make sure that the baffles is placed correctly.

Standard Accessories

A Morsø glove and ceramic flue connection gasket are standard accessories that usually can be found in the ashpan or firebox area.

1.2 The chimney / flue system

Note that the flue system must be independently secured and must not rely on the stove for support.

The stove must not be connected to a chimney flue serving any other appliance. (Several flues may run up a single chimney stack; use one flueway per appliance).

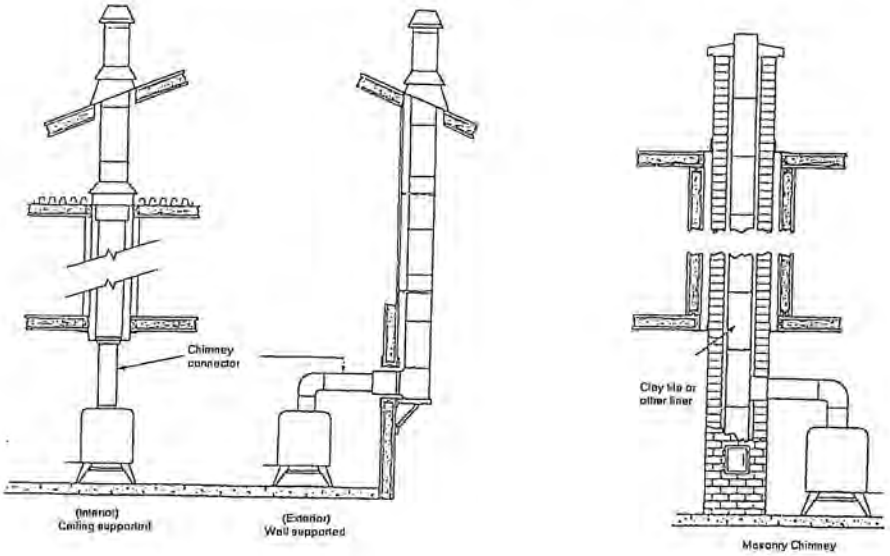
Use a residential type masonry or listed type HT factory-built chimney.

High Temperature (H.T.) Chimney Standard UL-103-1985 (2100° F.) or a code-approved masonry chimney with flue liner for the USA, and High Temperature (650°C) Standard ULC S-629 for Canada.

The internal dimensions of the chimney connector and chimney must not be less than 6 inches diameter (or equivalent cross section), and should not be significantly larger than this. Too large a section will tend to allow the flue gases to cool excessively, causing sluggishness or unpredictability in the stove's performance.

We recommend the length of the chimney system should be at least 16 feet (not required) above the stove in normal domestic situations, measured from the flue collar to the top of the chimney.
Local conditions like for example - roof constructions, large trees nearby and high altitude, may influence the chimney draft and height. Therefore, contact the local professional chimney sweep or your Morsø dealer.

Typical Factory-Built or Masonry Chimney Installations



1.3 Flue Connection

The stove is supplied from the factory with a round blanking plate blocking off the top and rear flue exit (behind the rear shield plate). A flue collar are placed in the firebox area.

Use a 24 MSG black or blue chimney connector or listed double wall chimney connector. Refer to local codes and the chimney manufacturer's instructions for precautions required for passing a chimney through a combustible wall or ceiling. Remember to secure the chimney connector with a minimum of three screws to the product and to each adjoining section.
The collar can be fitted to the rear outlet. Simply knock out the round panel on the rear heat shield plate to reveal the cast iron plate. Untwist the blanking plate and the flue collar and swap their positions. Re-secure by pushing down and tighten the enclosed screws.
Position the stove and connect to the flue system.

Wear gloves and protective eyewear when drilling, cutting or joining sections of chimney connector

1.4 Connection to the existing chimney

A chimney connector is the double-wall or single-wall pipe that connects the stove to the chimney. The chimney itself is the masonry or prefabricated structure that encloses the flue. Chimney connectors are used only to connect the stove to the chimney.

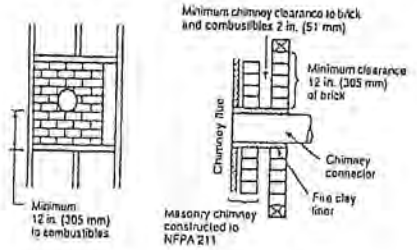
Double-wall connectors must be tested and listed for use with solid-fuel burning appliances. Single-wall connectors should be made of 24 gauge or heavier gauge steel. Do not use galvanized connector; it cannot withstand the high-temperatures that smoke and exhaust gases can reach, and may release toxic fumes under high heat. The connector must be 6 inches (150mm) in diameter.

If possible, do not pass the chimney connector through a combustible wall or ceiling. If passage through a combustible wall is unavoidable, refer to the sections on Wall Pass- Throughs. Do not pass the connector through an attic, a closet or similar concealed space when installing the chimney connectors.

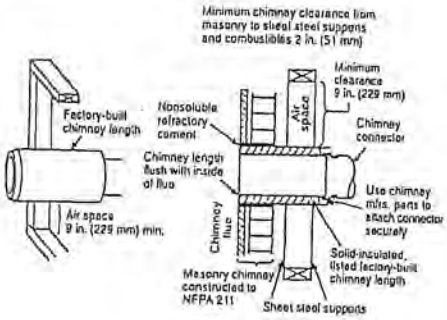
It is important to keep the flue gases moving smoothly in the right direction. Do not vent into a large void at this location; rather form one continuous section all the way up. Use mild bends (e.g. 45° vs. 90°) rather than sharp angles where a change of direction is required. All parts of the venting must be accessible for cleaning purposes.
In horizontal runs of chimney, maintain a distance of 18 inches from the ceiling. Keep it as short and direct as possible, with no more than two 90 degree turns. Slope horizontal runs of connector upward 1/4 inch per foot (20 mm per metre) going from the stove toward the chimney. The recommended maximum length of a horizontal run is 3 feet (1 metre), and the total length should be no longer than 8 feet (2.5 metres).
Information on assembling and installing connectors is provided by the manufacturer's instructions exactly as you assemble the connector and attach it to the stove and chimney.

Be sure the installed stove and chimney connector are correct distances from near by combustible materials. See the clearance paragraph page 8.

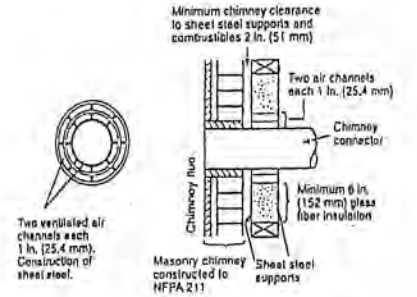
Where passage through a wall or partition of combustible construction is desired, the installation shall conform to CAN/CSA-B365.



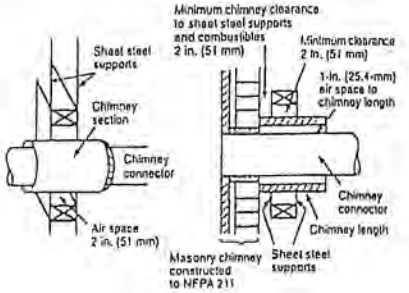
A Minimum 3.5-in thick brick masonry all framed into combustible wall with a minimum of 12-in brick separation from clay liner to combustibles. The fireclay liner shall run from outer surface of brick wall to, but not beyond, the inner surface of chimney flue liner and shall be firmly cemented in place.



B Solid-insulated, listed factory-built chimney length of the same inside diameter as the chimney connector and having 1-in. or more of insulation with a minimum 9-in. air space between the outer wall of the chimney length and combustibles.



C Sheet steel chimney connector, minimum 24 gauge in thickness, with a ventilated thimble, minimum 24 gauge in thickness, having two 1-in. air channels, separated from combustibles by a minimum of 6-in. of glass fiber insulation. Opening shall be covered, and thimble supported with a sheet steel support, minimum 24 gauge in thickness.



D Solid insulated, listed factory-built chimney length with an inside diameter 2-in. larger than the chimney connector and having 1-in. or more of insulation, serving as a pass-through for a single wall sheet steel chimney connector of minimum 24 gauge thickness, with a minimum 2-in. air space between the outer wall of chimney section and combustibles. Minimum length of chimney section shall be 12-in. chimney section spaced 1-in. away from connector using sheet steel support plates on both ends of chimney section. Opening shall be covered, and chimney section supported on both sides with sheet steel supports securely fastened to wall surfaces of minimum 24 gauge thickness. Fasteners used to secure chimney section shall not penetrate chimney flue liner.

1.5 Positioning the stove

Distance to walls and lintel

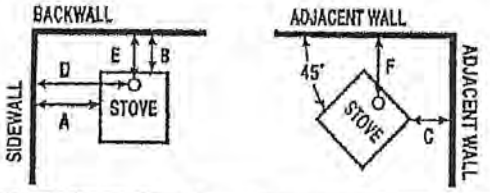
When the stove is positioned near combustible materials, observe all current local and national building regulations with regards to clearances. Whatever regulations apply to your area, do not in any case install the stove within 8 inches of combustible materials around the sides or 16 inches above the top of the stove (fireplace installations require greater clearances above the stove - see below in the clearance chart). These distances may need to be increased if the materials are sensitive to heat. Note also that wall paper and other decorative materials may become detached with the effects of heat and care should be taken to ensure that they do not fall towards the stove in such an event.

When the stove is positioned near non-combustible materials, a gap of 4 inches or more is recommended for cleaning purposes and to ensure that heat circulates around the stove and out into the room.

If using rear exit, the floor protection must extend beneath the chimney connector and 2-in beyond each side.

CLEARANCE REQUIREMENTS:	STANDARD RESIDENTIAL INSTALLATION SINGLEWALL CONNECTOR:	
	USA	Canada
A. SIDEWALL TO UNIT	10" (254 mm)	10" (254 mm)
B. BACKWALL TO UNIT	3" (76 mm)	3" (76 mm)
C. CORNERWALL TO UNIT	5" (127 mm)	5" (127 mm)
D. SIDEWALL TO CONNECTOR	15,5" (394 mm)	15,5" (394 mm)
E. BACKWALL TO CONNECTOR	7,5" (190 mm)	7,5" (190 mm)
F. CORNERWALL TO CONNECTOR	10" (254 mm)	10" (254 mm)
G. UNIT TO CEILING	-	-
H. FLOOR TO CEILING	-	-

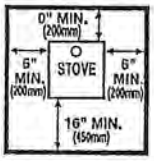
MINIMUM CLEARANCES TO COMBUSTIBLES:



CLEARANCE REQUIREMENTS:	STANDARD RESIDENTIAL INSTALLATION (DOUBLEWALL CONNECTOR):	
	USA	Canada
A. SIDEWALL TO UNIT	10" (254 mm)	10" (254 mm)
B. BACKWALL TO UNIT	2" (51 mm)	2" (51 mm)
C. CORNERWALL TO UNIT	5" (127 mm)	5" (127 mm)
D. SIDEWALL TO CONNECTOR	15,5" (394 mm)	15,5" (394 mm)
E. BACKWALL TO CONNECTOR	6,5" (165 mm)	6,5" (165 mm)
F. CORNERWALL TO CONNECTOR	10" (254 mm)	10" (254 mm)
G. UNIT TO CEILING	-	-
H. FLOOR TO CEILING	-	-

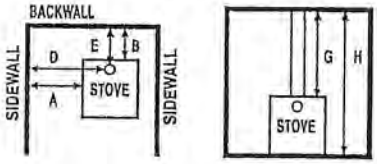
CLEARANCE REQUIREMENTS:	STANDARD RESIDENTIAL INSTALLATION REAR VENT OUT BACK WALL SINGLEWALL CONNECTOR:	
	USA	Canada
A. SIDEWALL TO UNIT	10" (254 mm)	10" (254 mm)
B. BACKWALL TO UNIT	6,5" (165 mm)	6,5" (165 mm)
C. CORNERWALL TO UNIT	-	-
D. SIDEWALL TO CONNECTOR	15,5" (394 mm)	15,5" (394 mm)
E. BACKWALL TO CONNECTOR	-	-
F. CORNERWALL TO CONNECTOR	-	-
G. UNIT TO CEILING	-	-
H. FLOOR TO CEILING	-	-

NON-COMBUSTIBLE FLOOR PROTECTOR



FLOOR PROTECTOR MUST BE NON-COMBUSTIBLE MATERIAL. IT MUST EXTEND BENEATH HEATER, AND TO THE FRONT/SIDES/REAR AS INDICATED.

ALCOVE INSTALLATION



*Maximum alcove depth must be no more than 48" (1220mm):

CLEARANCES IN ( ) IN MM FOR CANADA FOR NON-COMBUSTIBLE FLOOR PROTECTOR

CLEARANCE REQUIREMENTS:	ALCOVE INSTALLATION WITH (DOUBLE WALL CONNECTOR):
A. SIDEWALL TO UNIT	12" (305 mm)
B. BACKWALL TO UNIT	3" (76 mm)
C. CORNERWALL TO UNIT	-
D. SIDEWALL TO CONNECTOR	17" (432 mm)
E. BACKWALL TO CONNECTOR	7,5" (190 mm)
F. CORNERWALL TO CONNECTOR	-
G. UNIT TO CEILING	24,5" (622 mm)
H. FLOOR TO CEILING	54" (1372 mm)

Distance to furniture

The recommended minimum distance from stove to furniture is 30 inches. Note that some furniture is more easily affected by heat and may need to be moved to a greater distance. This is your responsibility.

In addition other combustible materials, away from the stove. In general, a distance of 30 inches must be maintained between the stove and moveable combustible item such as drying clothes, newspapers, firewood etc.

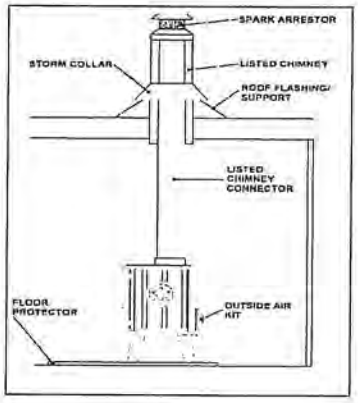
1.6 Mobile Home Installation

The Morsø 6100 can be installed in a mobile home if equipped with an outside combustion air kit, a terminal cap with a spark arrestor, and if it meets the following installation requirements:

- The stove must be secured to the mobile home structure by bolting through the hearth pad and into flooring.
- The stove must be installed with a listed Type HT chimney connector, HT Chimney, and terminal cap with spark arrestor. Never use a single wall connector (stovepipe) in a mobile home installation.
- Floor protection requirements in section 1.5 must be followed precisely.
- In Canada, this appliance must be connected to a 6" (152 mm) factory-built chimney conforming to CAN/ULC-629M, STANDARD FOR FACTORY BUILT CHIMNEYS. Floor protection as referenced in section 1.5 must be followed, as well as use of Canadian Floor Protector.
- Follow the chimney and chimney connector manufacturer's instructions when installing the flue system for use in a mobile home.
- Outside air kit should be installed according to installation guide in the kit.
- Intake air piping can be installed through the floor into a vented crawl space or through the wall of the residence to obtain outside air.
- Install in accordance with 24 CFR, Part 3280 (HUD).
- NOTE: Top sections of chimney must be removable to allow maximum clearance of 13.5' from ground level for transportation purposes.

WARNING:
NEVER DRAW COMBUSTION AIR FROM A WALL, FLOOR OR CEILING CAVITY OR FROM ANY ENCLOSED SPACE SUCH AS AN ATTIC OR GARAGE.
DO NOT INSTALL IN SLEEPING ROOM.

CAUTION:
THE STRUCTURAL INTEGRITY OF THE MOBILE HOME FLOOR, WALL, AND CEILING/ROOF MUST BE MAINTAINED (I.E., DO NOT CUT THROUGH FLOOR JOIST, WALL STUD, CEILING TRUSS, ETC.)
DO NOT USE A GRATE TO ELEVATE FIRE - BUILD FIRE DIRECTLY ON HEARTH.



Note:

Acid Protection

If acid-washing the masonry around the stove, protect the stove surface with an acid-proof cover

Fresh Air Inlet

Unless there is deemed to be sufficient ambient leakage of air into the room via doorways, windows and the like, a dedicated fresh air inlet will be needed. This inlet should have 2 square inches (1250 square mm) of free air space. This is particularly important where the room is well sealed, or where an extractor hood or ventilation system disturbs the natural air pressure. Such an inlet should not be on a wall that is usually subject to negative pressure from normal wind pattern. Avoid placing the inlet directly across the room from the stove, thus causing a cold air draft.

2.0 Operation

2.1 Before you start firing

For Use with Solid Wood Fuel Only. Do Not Overfire, If Heater or Chimney Connector Glows You Are Overfiring. Inspect and Clean Chimney Frequently. Under Certain Conditions of use creosote buildup may occur rapidly. Because of risk of smoke and flame spillage, operate only with door fully closed.

Caution:

Hot while in operation. Keep children, clothing and furniture away. Contact may cause skin burns.

Do not use chemicals or fluids to start the fire.

Do not burn garbage or flammable fluids.

Do not use gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter or fluid or similar liquids to start or freshen up a fire in this heater. Keep all such liquids away from the heater while it is in use.

Choosing your fuel
All types of natural wood can be burned on your stove, but they must be well-seasoned and dry. Once the wood is cut to length, it should be split down middle - to suit the dimensions given below - to allow moisture to evaporate.

Cut the wood to a length of max 13 inches (30 cm) and approx. 3 to 3.5 inches (7-8 cm) in section. If you can weigh your wood, aim for around 2 lbs. For correct combustion and heat output, wood fuel should contain no more than 20% moisture; this can easily be checked by using the Morsø Moisture Meter (part # 62929900)

To naturally season wood fuel, stack and store it under cover in an airy location where fresh air can move through each piece. Some soft woods may take as little as one good summer to season whereas harder woods such as oak, maple, and elm may require seasoning up to 18 months. Avoid overly dry wood that is gray in color as under certain conditions it can cause performance problems, such as back-puffing and sluggishness. Well seasoned wood will be light to hold and will show signs of cracking from the center-out in the ends. If your wood spits or sizzles when b urnt, and your stove's door glass persistently mists up, your wood is not properly seasoned. Never use drift wood (from the sea), whose salt content may cause corrosion, nor construction wood that may have been impregnated with chemicals.

Caution: Do not place fuel within the installation clearances for the stove or within the space required for loading fuel and ash removal.

Starting the First Fire
The initial fire should be small, so that the stove paint can cure and the main plates of the stove can settle into position. Some fumes will be given off by the paint. Ventilate the room during this phase.
The setting of the air control, lighting techniques and loading intervals will depend on chimney draft, the fuel used, the heat required and so on. Some basic techniques are outlined below.

In principle
Your stove should be with Primary and Secondary air and Pilot air inlets.
Primary Air is controlled using the lever situated over the door. Moving the control lever to right position will open the air inlet and will allow a supply of preheated air to enter the firebox via the 'airwash' system situated inside the stove and above the glass.
The secondary air is injected into the flue gases above the fire resulting in a cleaner, more efficient combustion process. The supply of secondary air and Pilot air is fixed open and is not adjustable.
For extra safety, your stove should be with a removable handle.

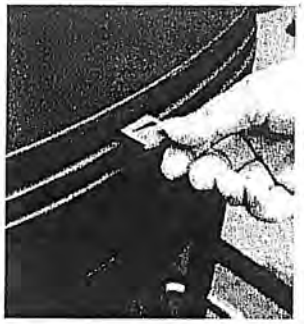
2.2 Lighting and loading intervals

When first lighting the stove, a large volume of air is needed. When the stove is cold, you should leave the door open an inch or two for the first few minutes and open the primary air supply completely. While the door is open, do not leave the stove unattended.

To form a reasonable bed of ash on the floor of the stove, you should use 2-4 pounds of dry kindling at the initial lighting. If possible, maintain a 1-1.5 inch (2-3 cm) layer of ash on the floor of the combustion chamber for added insulation.

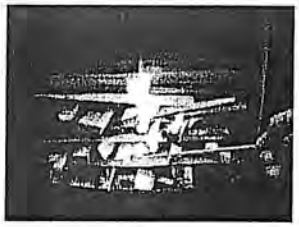
Step-by-step procedure

1. The air supply must be fully open.

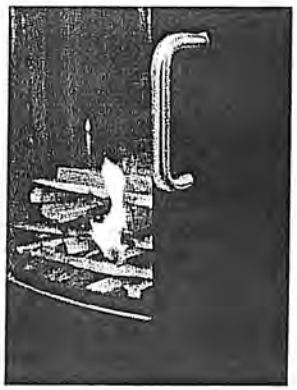


2. For lighting the fire use 2-3 pounds of dry kindling wood.

3. Light the fire. An ember bed will quickly be formed by lighting with firestarters, Morsø kindling bags or 7-10 pieces of twisted paper under the dry kindling wood.



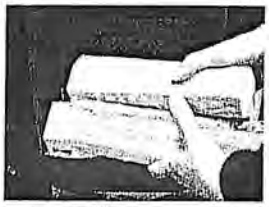
4. After lighting, partially close the door, leaving it open an inch or two to allow in plenty of combustion air.



5. When the chimney is warm after about 5-10 minutes, the door should be closed. A suitable layer of ember will be formed after about 15-20 minutes.

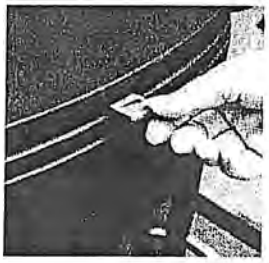
6. When ready to reload, use a poker to spread the embers across the firebox floor, bringing plenty towards the front of the stove.

7. Lay three pieces of wood onto the embers. Leave half an inch or more between each piece.
Max. fuelload 4,0 pounds/h.

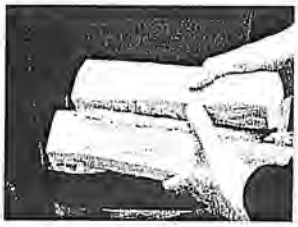


8. Close the door. Leave the primary air supply fully open.
If it does not light, leave the door slightly ajar to allow the necessary amount of air in to ignite the wood.
Close the door again once the wood has kindled.

9. After a few minutes, adjust the primary air supply to suit your heating requirements. Make sure that there is always enough air to sustain clear, enduring flames when you reduce the amount of combustion air, and afterwards.



10. For refueling, add a layer of wood while there are still plenty of live embers, repeat steps 6-9.



Do not for any reason attempt to increase the firing of your heater by altering the air control adjustment range outlined in these directions.

Warning: Fireplace stoves must never be left unattended with the door open.

If the door is left partly open, gas and flame may be drawn out of the fireplace stove opening, creating risks from both fire and smoke. We recommend that you fit a smoke detector in the room where the stove is installed.

DO NOT OVERFIRE THIS HEATER. Overfiring may cause a house fire, or can result in permanent damage to the stove. If any part of the stove glows, you are overfiring.

The maximum recommended weight of wood fuel per load is 2.0 kg/h/4.0lbs (approx 3 split logs).

Under normal firing, the average flue temperature in the stove pipe, measured 20 cm above the stove, is approx. 300° C (550°F). The maximum flue temperature in the stove pipe must not exceed 450° C (750°F). If the flue temperature exceeds 450°C (750°F), it is considered as over firing and may cause premature wear and tear of the stove.

To help gauge the correct running temperature of your stove, we recommend you use the Morsø Flue Gas Thermometer (part # 62901200). The Flue Gas Thermometer magnetically attaches onto the stove pipe approx 20 cm (8") above the stove's top plate and measures the surface temperature of the stove pipe. Please see your authorized Morsø Dealer for availability.

Draft conditions

If smoke or fumes come out of your stove when lightning up and reloading, or if the fire simply will not respond, a poor draft is almost certainly to blame. (In a very few cases, there may be insufficient fresh air getting into the room - see installation advice above). Take advice from your stove supplier on how best to upgrade your flue system to improve draft.

Rules of woodburning

If you want less heat, put fewer logs on the stove and reduce the amount of air. It is still important to maintain a good layer of embers.

Less heat - less wood - less air
Greater heat - more wood - more air
Soot deposits will settle on the glass if the stove is run too slowly or if your wood is not well seasoned.

We would strongly recommend that you do not leave your stove alit at night. It harms the environment, and constitutes very poor use of the wood, as the gases in the wood do not ignite at the low temperature, but settle as soot (unburned gases) in the chimney and stove instead.

3.0 MAINTENANCE

When perfoming maintenance on your stove, always protect yourself, using safety goggles and gloves.

3.1 Exterior Maintenance

The stove surface is painted with heat-resistant Senotherm paint. It is best kept clean by vacuuming with a soft brush attachment or by wiping with a lint-free cloth.
Over a period of time, the painted surface may become slightly grey. A can of Morsø touch-up spray paint should be available from your stove supplier. This can be applied - in accordance with the instructions - in just a few minutes. When first firing after touching up, the stove will give off a slight smell as the paint cures. Make sure to ventilate the room well during this phase.

3.2 Internal maintenance

Glass

If the stove is generally run at the correct temperatures, there should be little or no dirt on the glass. If dirt does settle during lighting, most will burn off as temperatures increase.For heavier deposits that will not burn off, use morsø glass cleaner, applied when the glass is cold, in accordance with the instructions. Never use abrasive cleaners on the glass surface.

Reasons for dirty glass

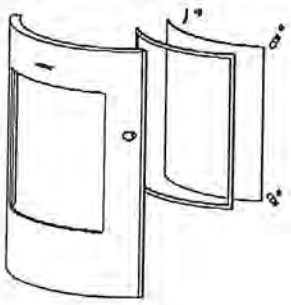
- **Fuel too wet**
- **Logs too large or not split**
- **Combustion temperatures too low**

Replace broken glass immediately.
Do not operate your stove if the glass in the door is damaged.

If you need to replace the glass, it should be replaced with the high temperature ceramic class supplied by Morsø, contact your Morsø dealer.

Installing the glass

Never install the glass when the stove is in function.



1. When you open the door, you will find two hinge pins, one in each hinge. Remove the two hinge pins, lift the door off the hinges and place it face down on a sheet of cardboard or other nonabrasive fabric.

2. Unscrew the 4 bolts that secure the glass. (In the event that a bolt sheers off when being unscrewed, remove the remaining body of the bolt by drilling down its centre with 1/8 inch high speed steel drill bit. Smaller drill bits may be successful, but do not use a lager bit. Make sure the bit stays away from the edges of the bolt - this may damage the thread in the cast iron).

3. Remove the old ceramic gaskets and clean up the surface underneath with wire wool or emery paper to remove loose particles.

4. Place the new gasket material in position around the perimeter of the window area, making sure to pinch them to the length in such a way that they make a continuous seal. Leave no gaps.

5. Place the new glass in position on the strips and screw home the fresh bolts and fitting by hand.

6. Finally, give each of the bolts an extra half turn or so. The glass should held tight enough by that cleaning will not dislodge it. Do not over-tighten the bolts as this may put excessive pressure on the glass, resulting in cracking - important!

To reduce the risk of breaking the glass, avoid striking the glass or slamming the door.

Internal service parts
The flame-path equipment - consisting of the ashpan, grate, firebricks, Cast iron fire plates, glass, baffle and flue collar - are subject to the extremes of heat produced by the fire. From time to time, one or other of these parts may need replacing as a matter of routine maintenance.

NOTE: The flame-path equipment, the ceramic rope and the paint finish are not covered by guarantee.

All of these service parts can be bought from your morsø dealer, and we recommend that damaged parts are replaced as soon as possible to avoid collateral damage.
Should the baffle be distorted by an overfire, the stove will still function, although its efficiency may be compromised. Replace it as soon as possible.

Reasons for fast internal wear and tear
Persistent heavy firing
Soot and ashes left to accumulate

Gasket
The gasket around the perimeter of the door may harden over a period of time. It should be replaced if it becomes difficult to close the doors or if air starts to leak in around the perimeter of the doors, causing the fire to become a little less controllable. A morsø rope gasket kit is available from your stove supplier.

3.3 Cleaning the Stove and the Flue

Check for soot above the baffle plate and around the flue outlet every month or so to start with. If the stove suddenly becomes sluggish, check for a soot fall around the flue collar or in the flue/chimney.

The chimney and chimney connector should be inspected at least once every two months during the heating season to determine if a creosote buildup has occurred. If creosote has accumulated, it should be removed to reduce the risk of a chimney fire.

Clean the flue/chimney - all the way from the stove to the flue terminal point above the house.

A good routine is to clean the flue after each heating season in any case, and inspect prior to the season to ensure that bird's nests or other blockages have not occurred during the off season.

Ash disposal
Empty the ashpan on a daily basis or as needed. Ash allowed to build up towards the underside of the grate will trap heat and could cause premature failure of the grate.

Empty the ashpan according to this procedure:
Open the front door, and use a shovel or poker to stir excess ash through the ash slots in the grate down into the ash pan. Take out the ash pan, making sure to keep it level to avoid spilling ash.
Dispose the ash in a metal container with a tight fitting lid.

The closed container of ashes should be placed on a noncombustible floor or on the ground, well away from all combustible materials, pending final disposal. If the ashes are disposed of by burial in soil or otherwise locally disperded, they should be retained in the closed container until all cinders have thoroughly cooled.

Return the ash pan to its original position in the stove, and close the door.

Caution:
Never empty a stove in operation.
Never use your household or shop vacuum cleaner to remove ash from the stove; always remove and dispose of the ash properly.

Creosote - formation and need for removal
When wood is burned slowly, it produces tar and other organic vapors, which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cool chimney flue of a slow-burning fire. As a result, creosote residue accumulates on the flue lining. When ignited this creosote makes an extremely hot fire. When burning wood, the chimney and chimney connector should be inspected at least once every two months during the heating season to determine if a creosote buildup has occurred. If creosote has accumulated, it should be removed to reduce the risk of a chimney fire.

Chimney sweeping
Inspect the system regularly during the heating season as part of a regular maintenance schedule. To inspect the chimney, let the stove cool completely. Then, using a mirror, sight up through the flue collar into the chimney flue. If you cannot inspect the flue system in this fashion, the stove must be disconnected to provide better viewing access.
Clean the chimney using a brush the same size and shape as the flue liner. Run the brush up and down the liner, causing any deposits to fall to the bottom of the chimney where they can be removed through the clean-out door.
Clean the chimney connector disconnecting the sections, taking them outside, and removing any deposits with a stiff wire brush. Reinstall the connector sections after cleaning, being sure to secure the joints between individual sections with sheet metal screws.
If you cannot inspect or clean the chimney yourself, contact your local Morsø Dealer or a professional chimney sweep.

If you do experience a chimney fire, act promptly and:
Close the air control.
Get everyone out of the house.
Call the Fire Department.

Annual maintenance
Before the heating season, perform a thorough cleaning, inspection and repair:
Thoroughly clean the chimney and chimney connector.
Inspect the chimney for damage and deterioration. Replace weak sections of prefabricated chimney. Have a mason make repairs to a masonry chimney.
Inspect the chimney connector and replace any damaged sections.
Check gasketing for wear or compression, and replace if necessary.
Check the glass for cracking; replace if needed.
Check door and handle for tightness. Adjust if needed.

How to clean the inside parts of Morsø 8100
When cleaning the inside parts of the stove in connection with the annual visits from your local chimney sweep we recommend that you remove the inside parts from the fire chamber. Please be careful as the vermiculite parts are porous. Cleaning of the stove must be done when the stove is cold.

1. The bottom baffle is lifted up a bit and held in that position. Loosen the side bricks.

2. Tip the side bricks and remove them from the fire chamber.

3. Tip the other side brick and remove it from the fire chamber.

4 When the side bricks are removed the bottom baffle is lowered and lifted out of the fire chamber.

5. The upper baffle is removed from the brackets and lifted out of the firechamber.

3.4 Leaving the stove for extended periods

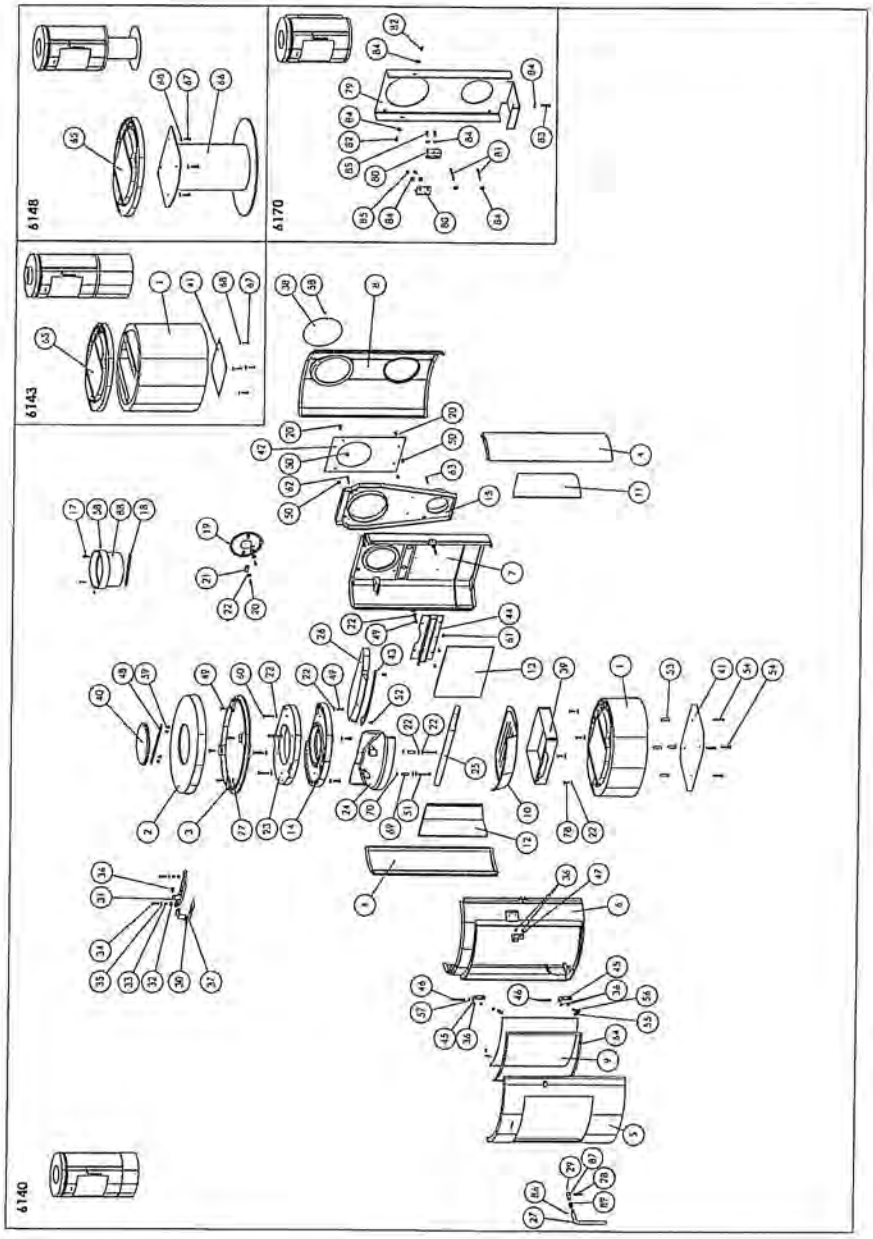
Important:

If the stove is to be left unused for any period of time, clean it out thoroughly and leave the air control slightly open to allow airflow. Make sure that the flue does not allow rainwater to come anywhere near the stove; install a chimney cap, but do not block off the flue completely.
These measures should ensure there is a slight movement of air through the stove, and that the body of the stove remains dry, right into the corners.
Any ash left within an unfired stove can attract moisture like blotting paper. If moisture is allowed to settle within the stove, rust will form. Rust expands as it takes a grip. This can lead to undue pressure on the stove joints, and this in turn may result in damage to the stove.

NOTE: It is best to thoroughly clean the stove after the heating season has concluded. Adding a dessicant, such as kitter litter, into the ash pan helps absorb moisture during the summer months. Be sure to remove this prior to the heating season.

We hope you have many years of carefree warmth in its company. Some initial experimentation with loading and running techniques will decide your normal routine. If you have any problems after this short learning phase, please refer to your stove dealer. Should they be unable to help for any reason, please contact us in writing at the address on the front of this publication.

3.5 Parts diagram for model Morsø 6100



3.6 Parts list for model Morsø 6100

Posnr.	Parts:	6140 NA	6143 NA	6148 NA
1	Socle	446101xx	716124xx	%
2	Top plate, outside	446109xx	446109xx	446109xx
3	Top frame	346106xx	346106xx	346106xx
4	Side plate, outside	346107xx	346107xx	346107xx
5	Door	446103xx	446103xx	446103xx
6	Front frame	446102xx	446102xx	446102xx
7	Rear plate, inside	446104xx	446104xx	446104xx
8	Rear plate, outside	446108xx	446108xx	446108xx
9	Glass	79610100	79610100	79610100
10	Intermediate frame	346110	346110	346110
11	Brick, side, right	79610200	79610200	79610200
12	Brick, side, left	79610300	79610300	79610300
13	Brick, back	79610400	79610400	79610400
14	Top plate, inside	44610500	44610500	44610500
15	Air canal, rear	44611200	44611200	44611200
16	Flue collar	%	%	%
17	Screw	%	%	%
18	Stop bar	%	%	%
19	Cover	441410xx	441410xx	441410xx
20	Screw	731616	731616	731616
21	Lug	44256800	44256800	44256800
22	Washer	791891	791891	791891
23	Air canal, top	446113xx	446113xx	446113xx
24	Air canal, front	446116xx	446116xx	446116xx
25	Baffle plate, lower	79610500	79610500	79610500
26	Baffle plate, top	79610600	79610600	79610600
27	Handle	75610061	75610061	75610061
28	Hinge pin	542056	542056	542056
29	Screw	73950500	73950500	73950500
30	Handle f. sek. draught control	71611261	71611261	71611261
31	Sek. draught control	71611100	71611100	71611100
32	Distance tube	71810300	71810300	71810300
33	Distance tube	71810200	71810200	71810200
34	Screw	74162000	74162000	74162000
35	Washer	736106	736106	736106
36	Screw	73851100	73851100	73851100
37	Closing plate for sek. draught control	71610800	71610800	71610800
38	Roundel	716110xx	716110xx	716110xx
39	Ash can	71610100	71610100	71610100
40	Cover	448120xx	448120xx	448120xx
41	Radiant shielding, bottom	71610300	71612500	%
42	Radiant shielding, rear	71610200	71610200	71610200
43	Fitting plate for baffle	71610461	71610461	71610461
44	Tertiary box	71610561	71610561	71610561
45	Hinge fitting	718101xx	718101xx	718101xx

Posnr.	Parts:	6140 NA	6143 NA	6148 NA
46	Screw	74701000	74701000	74701000
47	Closing fitting	71610700	71610700	71610700
48	Lug for cover	71813200	71813200	71813200
49	Screw	731625	731625	731625
50	Distance tube	541439	541439	541439
51	Screw	731650	731650	731650
52	Screw	731612	731612	731612
53	Distance tube	542641	542641	%
54	Screw	731640	731640	%
55	Glass fitting	71814561	71814561	71814561
56	Screw	742508	742508	742508
57	Washer	746006	746006	746006
58	Screw	791835	791835	791835
59	Screw	731608	731608	731608
60	Screw	731640	731640	731640
61	Screw	74361000	74361000	74361000
62	Screw	731635	731635	731635
63	Screw	731630	731630	731630
64	Tape for glass	79074200	79074200	79074200
65	Bottom plate	%	446115xx	446115xx
66	Pedestal	%	%	546115xx
67	Screw	%	%	731625
68	Washer	%	%	791891
69	Distance tube	541440	541440	541440
70	Washer	746206	746206	746206
71	Flue collar	441419xx	441419xx	441419xx
72	Stop bar	71611800	71611800	71611800
75	Spring	%	%	%
76	Screw	%	%	%
77	Washer	736210	736210	736210
78	Screw	731620	731620	731620
79	Fitting for wall	%	%	%
80	Fitting for fitting for wall	%	%	%
81	Screw	%	%	%
82	Screw	%	%	%
83	Screw	%	%	%
84	Washer	%	%	%
85	Screw	%	%	%
86	Cotter pin	74201900	74201900	74201900
87	Axle f. door	75610161	75610161	75610161
88	Flue collar	446118xx	446118xx	446118xx
89	Spring	79048800	79048800	79048800

By appointment to The Royal Danish Court

morsø

Installation and Operating Instructions

6170

For use in North America

Read this entire manual before you install and use your new room heater. If this room heater is not properly installed, a house fire may result. To reduce the risk of fire, follow the installation instructions. Failure to follow instructions may result in property damage, bodily injury, or even death.

Contact local building officials about restrictions and installation/inspection-requirements in your area.

Save these instructions

MORSØ JERNSTØBERI A/S . DK-7900 NYKØBING MORS
E-Mail: stoves@morsoe.com · Website: www.morsoe.com

Distributed by: MORSO US LLC
1011 Highway 52 West - Portland TN - 37148 - USA

We congratulate you on your choice of a Morsø stove. Morsø has been producing some of the world's best stoves since 1853. If you follow this installation- and operating instruction carefully, we can assure you many years of warmth and pleasure.

Optional Accessories
A wide range of accessories (such as handling gloves, fireside tools, glass cleaner and heatproof paint) are available for use with your Morsø stove. They help with day-to-day running and maintenance. Contact your Morsø dealer for more information.

The Morsø 6170 meets the U.S. Environmental Protection Agency's emission limits for wood heaters sold on or after July 1, 1990

The Morsø 6170 have been tested by OMNI-Test Laboratories, Inc. The test standards are ANSI/UL-1482 for the United States and ULC S627 for Canada.

The stove is listed for burning wood only. Do not burn other fuels.

Under specific test conditions this heater has been shown to deliver heat at rates ranging from xx,xxx to xx,xxx Btu´s.

NATIONAL FIREPLACE INSTITUTE NFI CERTIFIED www.nficertified.org

We recommend that our pellet hearth products be installed and serviced by professionals who are certified in the U.S. by the National Fireplace Institute® (NFI) as NFI Pellet Specialists or who are certified in Canada by Wood Energy Technical Training (WETT).

Wood Energy Technical Training

CONTENTS:

1.0 Installation of your Morsø stove

Installation of woodburning stoves must be safe and legal.

Consult with a structural engineer for the installation.

If your Morsø stove is not installed correctly, it may cause a house fire. To reduce the risk of fire, the installation instructions must be followed carefully. Contact the local building officials about restrictions and installation inspection in your area.

Before you start installing your stove, make sure that:

- The stove and chimney connection are placed far enough from combustible materials to meet all clearance requirements.
- The floor protection must be adequate and must be made correctly according to the requirements.

All neccessary approvals are needed from the local building officials.

The data plate, which is located on the back of the stove, provides information regarding safety testing information, name of certified testing laboratory, and installation requirements.

Installation requirements vary in different districts, and the local building officials have the final authorization to approve your installation. You should discuss the installation with them before beginning. Please ask your dealer for further information.

Do not connect to any air distribution duct or system.

Important: If the installation instructions are not followed carefully, it may cause dangerous situations like chimney - and house fires. Follow the instructions carefully and do not deviate from them as it may cause injuries to people or property.

1.1 Checking loose parts in the stove

After unpacking, check that the fire bricks are firmly in position and have not shifted in transit. Check also that the air control works freely.

Before starting the initial fire, make sure that the baffles is placed correctly.

Standard Accessories

A Morsø glove and ceramic flue connection gasket are standard accessories that usually can be found in the ashpan or firebox area.

1.2 The chimney / flue system

Note that the flue system must be independently secured and must not rely on the stove for support.

The stove must not be connected to a chimney flue serving any other appliance. (Several flues may run up a single chimney stack; use one flueway per appliance).

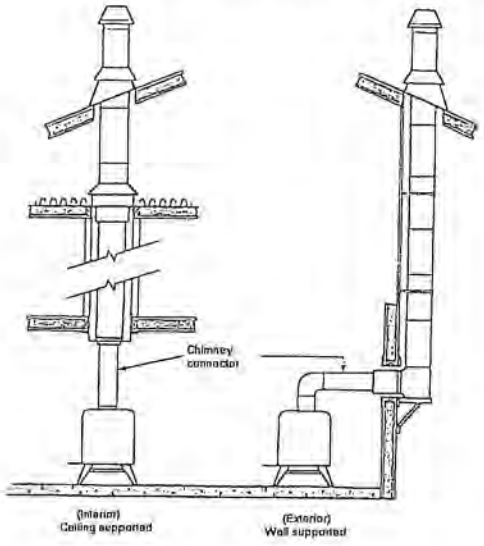
Use a residential type masonry or listed type HT factory-built chimney.

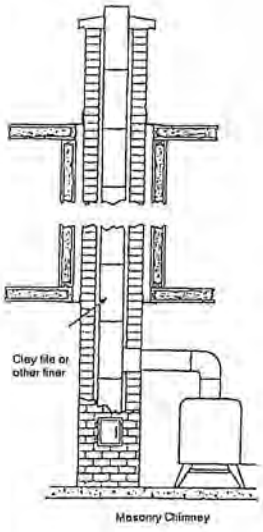
High Temperature (H.T.) Chimney Standard UL-103-1985 (2100° F.) or a code-approved masonry chimney with flue liner for the USA, and High Temperature (650°C) Standard ULC S-629 for Canada.

The internal dimensions of the chimney connector and chimney must not be less than 6 inches diameter (or equivalent cross section), and should not be significantly larger than this. Too large a section will tend to allow the flue gases to cool excessively, causing sluggishness or unpredictability in the stove's performance.

We recommend the length of the chimney system should be at least 16 feet (not required) above the stove in normal domestic situations, measured from the flue collar to the top of the chimney.
Local conditions like for example - roof constructions, large trees nearby and high altitude, may influence the chimney draft and height. Therefore, contact the local professional chimney sweep or your Morsø dealer.

Typical Factory-Built or Masonry Chimney Installations





1.3 Flue Connection

The stove is supplied from the factory with a round blanking plate blocking off the top and rear flue exit (behind the rear shield plate). A flue collar are placed in the firebox area.

Use a 24 MSG black or blue chimney connector or listed double wall chimney connector. Refer to local codes and the chimney manufacturer's instructions for precautions required for passing a chimney through a combustible wall or ceiling. Remember to secure the chimney connector with a minimum of three screws to the product and to each adjoining section.
The collar can be fitted to the rear outlet. Simply knock out the round panel on the rear heat shield plate to reveal the cast iron plate. Untwist the blanking plate and the flue collar and swap their positions. Re-secure by pushing down and tighten the enclosed screws.
Position the stove and connect to the flue system.

Wear gloves and protective eyewear when drilling, cutting or joining sections of chimney connector

1.4 Connection to the existing chimney

A chimney connector is the double-wall or single-wall pipe that connects the stove to the chimney. The chimney itself is the masonry or prefabricated structure that encloses the flue. Chimney connectors are used only to connect the stove to the chimney.

Double-wall connectors must be tested and listed for use with solid-fuel burning appliances. Single-wall connectors should be made of 24 gauge or heavier gauge steel. Do not use galvanized connector; it cannot withstand the high-temperatures that smoke and exhaust gases can reach, and may release toxic fumes under high heat. The connector must be 6 inches (150 mm) in diameter.

If possible, do not pass the chimney connector through a combustible wall or ceiling. If passage through a combustible wall is unavoidable, refer to the sections on Wall Pass- Throughs. Do not pass the connector through an attic, a closet or similar concealed space when installing the chimney connectors.

It is important to keep the flue gases moving smoothly in the right direction. Do not vent into a large void at this location; rather form one continuous section all the way up. Use mild bends (e.g. 45° vs. 90°) rather than sharp angles where a change of direction is required. All parts of the venting must be accessible for cleaning purposes.
In horizontal runs of chimney, maintain a distance of 18 inches from the ceiling. Keep it as short and direct as possible, with no more than two 90 degree turns. Slope horizontal runs of connector upward 1/4 inch per foot (20 mm per metre) going from the stove toward the chimney. The recommended maximum length of a horizontal run is 3 feet (1 metre), and the total length should be no longer than 8 feet (2.5 metres).
Information on assembling and installing connectors is provided by the manufacturer's instructions exactly as you assemble the connector and attach it to the stove and chimney.

Be sure the installed stove and chimney connector are correct distances from near by combustible materials. See the clearance paragraph page 8.

Where passage through a wall or partition of combustible construction is desired, the installation shall conform to CAN/CSA-B365.

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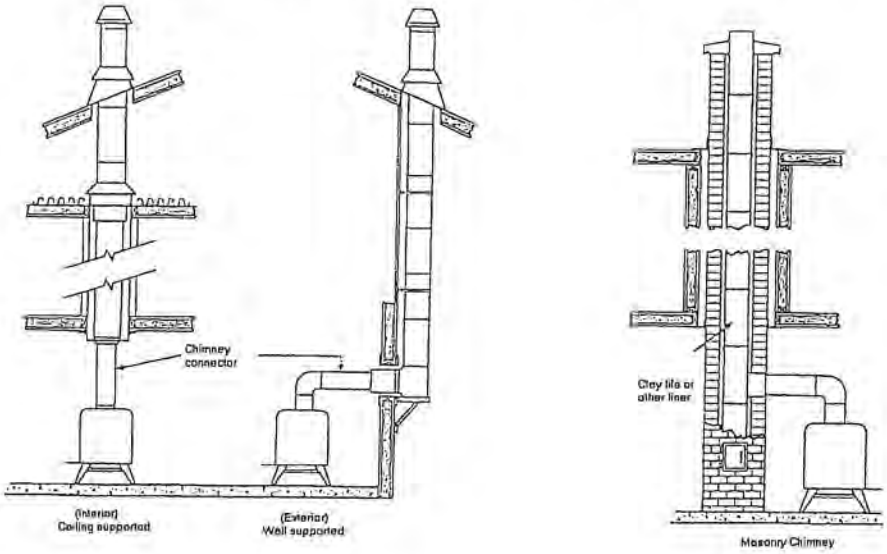
Typical Factory-Built or Masonry Chimney Installations



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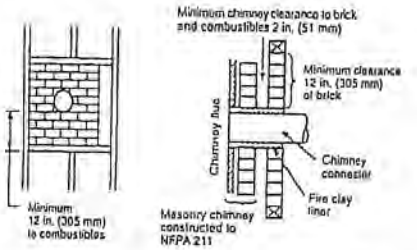
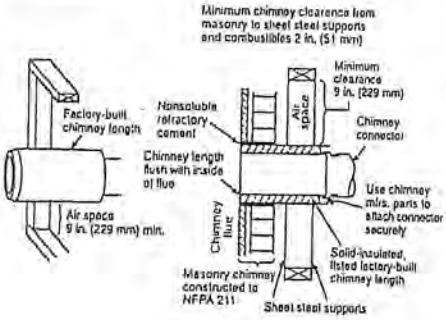
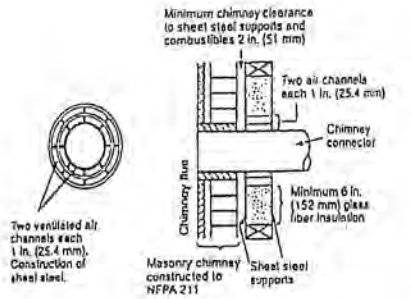


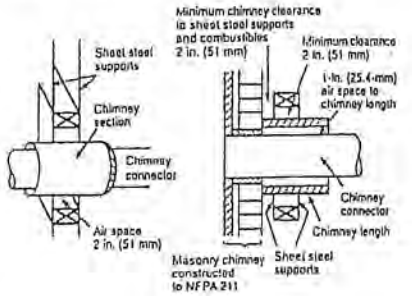
A Minimum 3.5-in thick brick masonry all framed into combustible wall with a minimum of 12-in brick separation from clay liner to combustibles. The fireclay liner shall run from outer surface of brick wall to, but not beyond, the inner surface of chimney flue liner and shall be firmly cemented in place.



B Solid-insulated, listed factory-built chimney length of the same inside diameter as the chimney connector and having 1-in. or more of insulation with a minimum 9-in. air space between the outer wall of the chimney length and combustibles.



C Sheet steel chimney connector, minimum 24 gauge in thickness, with a ventilated thimble, minimum 24 gauge in thickness, having two 1-in. air channels, separated from combustibles by a minimum of 6-in. of glass fiber insulation. Opening shall be covered, and thimble supported with a sheet steel support, minimum 24 gauge in thickness.



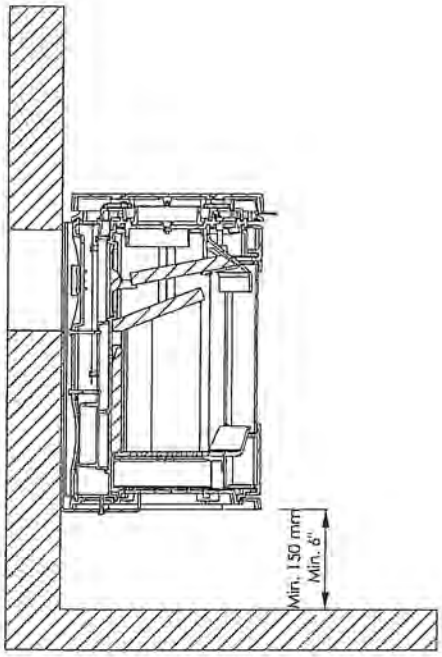
D Solid insulated, listed factory-built chimney length with an inside diameter 2-in. larger than the chimney connector and having 1-in. or more of insulation, serving as a pass-through for a single wall sheet steel chimney connector of minimum 24 gauge thickness, with a minimum 2-in. air space between the outer wall of chimney section and combustibles. Minimum length of chimney section shall be 12-in. chimney section spaced 1-in. away from connector using sheet steel support plates on both ends of chimney section. Opening shall be covered, and chimney section supported on both sides with sheet steel supports securely fastened to wall surfaces of minimum 24 gauge thickness. Fasteners used to secure chimney section shall not penetrate chimney flue liner.

1.5 Positioning the stove

The wall-mounting fixture is provided with four holes for mounting expansion bolts in the wall. The bolts must be sized to secure that the wall and the materials it is made from are capable of supporting the stove. If in doubt, contact an expert. The weight of the empty stove is 105 kg (232 lbs.). The wall-mounting fixture may be used as drilling template.

Mount the wall-mounting fixture on the wall. If the flue exit is wanted to the rear, build a wall bushing correctly into the wall (see illustration).

Lift the wood stove in place so that it rests on the bottom part of the wall-mounting fixture, and secure it again to the fixture by means of the screws included.



Distance to walls and lintel

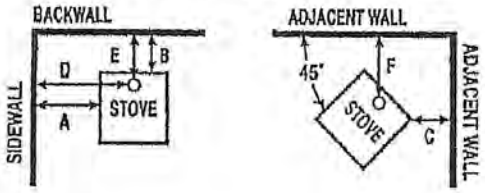
When the stove is positioned near combustible materials, observe all current local and national building regulations with regards to clearances. Whatever regulations apply to your area, do not in any case install the stove within 8 inches of combustible materials around the sides or 16 inches above the top of the stove (fireplace installations require greater clearances above the stove - see below in the clearance chart). These distances may need to be increased if the materials are sensitive to heat. Note also that wall paper and other decorative materials may become detached with the effects of heat and care should be taken to ensure that they do not fall towards the stove in such an event.

When the stove is positioned near non-combustible materials, a gap of 4 inches or more is recommended for cleaning purposes and to ensure that heat circulates around the stove and out into the room.

If using rear exit, the floor protection must extend beneath the chimney connector and 2-in beyond each side.

CLEARANCE REQUIREMENTS:	STANDARD RESIDENTIAL INSTALLATION SINGLEWALL CONNECTOR:	
	USA	Canada
A. SIDEWALL TO UNIT	10" (254 mm)	10" (254 mm)
B. BACKWALL TO UNIT	3" (76 mm)	3" (76 mm)
C. CORNERWALL TO UNIT	5" (127 mm)	5" (127 mm)
D. SIDEWALL TO CONNECTOR	15,5" (394 mm)	15,5" (394 mm)
E. BACKWALL TO CONNECTOR	7,5" (190 mm)	7,5" (190 mm)
F. CORNERWALL TO CONNECTOR	10" (254 mm)	10" (254 mm)
G. UNIT TO CEILING	-	-
H. FLOOR TO CEILING	-	-

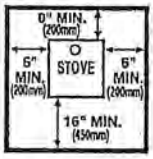
MINIMUM CLEARANCES TO COMBUSTIBLES:



CLEARANCE REQUIREMENTS:	STANDARD RESIDENTIAL INSTALLATION (DOUBLEWALL CONNECTOR):	
	USA	Canada
A. SIDEWALL TO UNIT	10" (254 mm)	10" (254 mm)
B. BACKWALL TO UNIT	2" (51 mm)	2" (51 mm)
C. CORNERWALL TO UNIT	5" (127 mm)	5" (127 mm)
D. SIDEWALL TO CONNECTOR	15,5" (394 mm)	15,5" (394 mm)
E. BACKWALL TO CONNECTOR	6,5" (165 mm)	6,5" (165 mm)
F. CORNERWALL TO CONNECTOR	10" (254 mm)	10" (254 mm)
G. UNIT TO CEILING	-	-
H. FLOOR TO CEILING	-	-

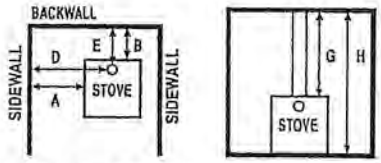
CLEARANCE REQUIREMENTS:	STANDARD RESIDENTIAL INSTALLATION REAR VENT OUT BACK WALL SINGLEWALL CONNECTOR:	
	USA	Canada
A. SIDEWALL TO UNIT	10" (254 mm)	10" (254 mm)
B. BACKWALL TO UNIT	6,5" (165 mm)	6,5" (165 mm)
C. CORNERWALL TO UNIT	-	-
D. SIDEWALL TO CONNECTOR	15,5" (394 mm)	15,5" (394 mm)
E. BACKWALL TO CONNECTOR	-	-
F. CORNERWALL TO CONNECTOR	-	-
G. UNIT TO CEILING	-	-
H. FLOOR TO CEILING	-	-

NON-COMBUSTIBLE FLOOR PROTECTOR



FLOOR PROTECTOR MUST BE NON-COMBUSTIBLE MATERIAL. IT MUST EXTEND BENEATH HEATER, AND TO THE FRONT/SIDES/REAR AS INDICATED.

ALCOVE INSTALLATION



*Maximum alcove depth must be no more than 48" (1220mm).

CLEARANCES IN ( ) IN MM FOR CANADA FOR NON-COMBUSTIBLE FLOOR PROTECTOR

CLEARANCE REQUIREMENTS:	ALCOVE INSTALLATION WITH (DOUBLE WALL CONNECTOR):
A. SIDEWALL TO UNIT	12" (305 mm)
B. BACKWALL TO UNIT	3" (76 mm)
C. CORNERWALL TO UNIT	-
D. SIDEWALL TO CONNECTOR	17" (432 mm)
E. BACKWALL TO CONNECTOR	7,5" (190 mm)
F. CORNERWALL TO CONNECTOR	-
G. UNIT TO CEILING	24,5" (622 mm)
H. FLOOR TO CEILING	54" (1372 mm)

Distance to furniture

The recommended minimum distance from stove to furniture is 30 inches. Note that some furniture is more easily affected by heat and may need to be moved to a greater distance. This is your responsibility.

In addition other combustible materials, away from the stove. In general, a distance of 30 inches must be maintained between the stove and moveable combustible item such as drying clothes, newspapers, firewood etc.

WARNING:
NEVER DRAW COMBUSTION AIR FROM A WALL, FLOOR OR CEILING CAVITY OR FROM ANY ENCLOSED SPACE SUCH AS AN ATTIC OR GARAGE.
DO NOT INSTALL IN SLEEPING ROOM.

Note:

Acid Protection

If acid-washing the masonry around the stove, protect the stove surface with an acid-proof cover

Fresh Air Inlet

Unless there is deemed to be sufficient ambient leakage of air into the room via doorways, windows and the like, a dedicated fresh air inlet will be needed. This inlet should have 2 square inches (1250 square mm) of free air space. This is particularly important where the room is well sealed, or where an extractor hood or ventilation system disturbs the natural air pressure. Such an inlet should not be on a wall that is usually subject to negative pressure from normal wind pattern. Avoid placing the inlet directly across the room from the stove, thus causing a cold air draft.

2.0 Operation

2.1 Before you start firing

For Use with Solid Wood Fuel Only. Do Not Overfire, If Heater or Chimney Connector Glows You Are Overfiring. Inspect and Clean Chimney Frequently. Under Certain Conditions of use creosote buildup may occur rapidly. Because of risk of smoke and flame spillage, operate only with door fully closed.
Caution:
Hot while in operation. Keep children, clothing and furniture away. Contact may cause skin burns.
Do not use chemicals or fluids to start the fire.
Do not burn garbage or flammable fluids.
Do not use gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter or fluid or similar liquids to start or freshen up a fire in this heater. Keep all such liquids away from the heater while it is in use.

Choosing your fuel
Cut the wood to a length of max 13 inches (30 cm) and approx. 3 to 3.5 inches (7-8 cm) in section. If you can weigh your wood, aim for around 2 lbs. For correct combustion and heat output, wood fuel should contain no more than 20% moisture; this can easily be checked by using the Morsø Moisture Meter (part # 62929900)

To naturally season wood fuel, stack and store it under cover in an airy location where fresh air can move through each piece. Some soft woods may take as little as one good summer to season whereas harder woods such as oak, maple, and elm may require seasoning up to 18 months. Avoid overly dry wood that is gray in color as under certain conditions it can cause performance problems, such as back-puffing and sluggishness. Well seasoned wood will be light to hold and will show signs of cracking from the center-out in the ends. If your wood spits or sizzles when burnt, and your stove's door glass persistently mists up, your wood is not properly seasoned. Never use drift wood (from the sea), whose salt content may cause corrosion, nor construction wood that may have been impregnated with chemicals.

Caution: Do not place fuel within the installation clearances for the stove or within the space required for loading fuel and ash removal.

Starting the First Fire
The initial fire should be small, so that the stove paint can cure and the main plates of the stove can settle into position. Some fumes will be given off by the paint. Ventilate the room during this phase.
The setting of the air control, lighting techniques and loading intervals will depend on chimney draft, the fuel used, the heat required and so on. Some basic techniques are outlined below.

In principle
Your stove should be with Primary and Secondary air and Pilot air inlets.
Primary Air is controlled using the lever situated over the door. Moving the control lever to right position will open the air inlet and will allow a supply of preheated air to enter the firebox via the 'airwash' system situated inside the stove and above the glass.

The secondary air is injected into the flue gases above the fire resulting in a cleaner, more efficient combustion process. The supply of secondary air and Pilot air is fixed open and is not adjustable.
For extra safety, your stove should be with a removable handle.

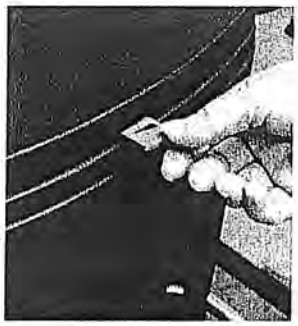
2.2 Lighting and loading intervals

When first lighting the stove, a large volume of air is needed. When the stove is cold, you should leave the door open an inch or two for the first few minutes and open the primary air supply completely. While the door is open, do not leave the stove unattended.

To form a reasonable bed of ash on the floor of the stove, you should use 2-4 pounds of dry kindling at the initial lighting. If possible, maintain a 1-1.5 inch (2-3 cm) layer of ash on the floor of the combustion chamber for added insulation.

Step-by-step procedure

1. The air supply must be fully open.



2. For lighting the fire use 2-3 pounds of dry kindling wood.

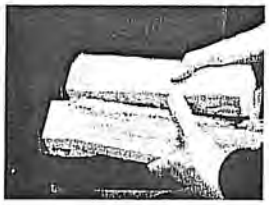
3. Light the fire. An ember bed will quickly be formed by lighting with firestarters, Morsø kindling bags or 7-10 pieces of twisted paper under the dry kindling wood.

4. After lighting, partially close the door, leaving it open an inch or two to allow in plenty of combustion air.

5. When the chimney is warm after about 5-10 minutes, the door should be closed. A suitable layer of ember will be formed after about 15-20 minutes.

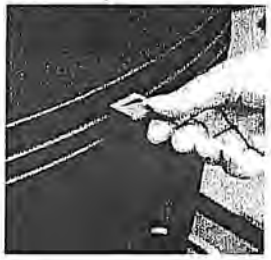
6. When ready to reload, use a poker to spread the embers across the firebox floor, bringing plenty towards the front of the stove.

7. Lay three pieces of wood onto the embers. Leave half an inch or more between each piece.
   Max. fuelload 4.0 pounds/h.



8. Close the door. Leave the primary air supply fully open.
   If it does not light, leave the door slightly ajar to allow the necessary amount of air in to ignite the wood.
   Close the door again once the wood has kindled.

9. After a few minutes, adjust the primary air supply to suit your heating requirements. Make sure that there is always enough air to sustain clear, enduring flames when you reduce the amount of combustion air, and afterwards.



10. For refueling, add a layer of wood while there are still plenty of live embers, repeat steps 6-9.

Do not for any reason attempt to increase the firing of your heater by altering the air control adjustment range outlined in these directions.

Warning: Fireplace stoves must never be left unattended with the door open.

If the door is left partly open, gas and flame may be drawn out of the fireplace stove opening, creating risks from both fire and smoke. We recommend that you fit a smoke detector in the room where the stove is installed.

DO NOT OVERFIRE THIS HEATER. Overfiring may cause a house fire, or can result in permanent damage to the stove. If any part of the stove glows, you are overfiring.

The maximum recommended weight of wood fuel per load is 2.0 kg/h/4.0lbs (approx 3 split logs).

Under normal firing, the average flue temperature in the stove pipe, measured 20 cm above the stove, is approx. 300° C (550°F). The maximum flue temperature in the stove pipe must not exceed 450° C (750°F). If the flue temperature exceeds 450°C (750°F), it is considered as over firing and may cause premature wear and tear of the stove.

To help gauge the correct running temperature of your stove, we recommend you use the Morsø Flue Gas Thermometer (part # 62901200). The Flue Gas Thermometer magnetically attaches onto the stove pipe approx 20 cm (8") above the stove's top plate and measures the surface temperature of the stove pipe. Please see your authorized Morsø Dealer for availability.

Draft conditions

If smoke or fumes come out of your stove when lightning up and reloading, or if the fire simply will not respond, a poor draft is almost certainly to blame. (In a very few cases, there may be insufficient fresh air getting into the room - see installation advice above). Take advice from your stove supplier on how best to upgrade your flue system to improve draft.

Rules of woodburning

If you want less heat, put fewer logs on the stove and reduce the amount of air. It is still important to maintain a good layer of embers.

Less heat - less wood - less air
Greater heat - more wood - more air
Soot deposits will settle on the glass if the stove is run too slowly or if your wood is not well seasoned.

We would strongly recommend that you do not leave your stove alit at night. It harms the environment, and constitutes very poor use of the wood, as the gases in the wood do not ignite at the low temperature, but settle as soot (unburned gases) in the chimney and stove instead.

3.0 MAINTENANCE

When perfoming maintenance on your stove, always protect yourself, using safety goggles and gloves.

3.1 Exterior Maintenance

The stove surface is painted with heat-resistant Senotherm paint. It is best kept clean by vacuuming with a soft brush attachment or by wiping with a lint-free cloth.

Over a period of time, the painted surface may become slightly grey. A can of Morsø touch-up spray paint should be available from your stove supplier. This can be applied - in accordance with the instructions - in just a few minutes. When first firing after touching up, the stove will give off a slight smell as the paint cures. Make sure to ventilate the room well during this phase.

3.2 Internal maintenance

Glass

If the stove is generally run at the correct temperatures, there should be little or no dirt on the glass. If dirt does settle during lighting, most will burn off as temperatures increase.For heavier deposits that will not burn off, use morsø glass cleaner, applied when the glass is cold, in accordance with the instructions. Never use abrasive cleaners on the glass surface.

Reasons for dirty glass

- **Fuel too wet**
- **Logs too large or not split**
- **Combustion temperatures too low**

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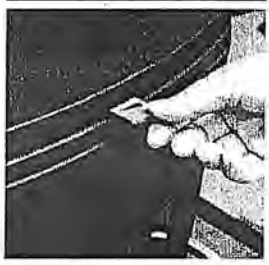

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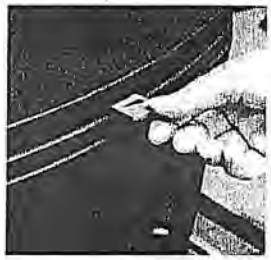

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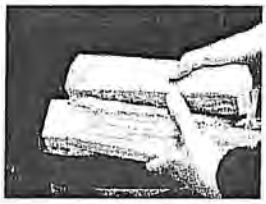

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Reasons for dirty glass

- **Fuel too wet**
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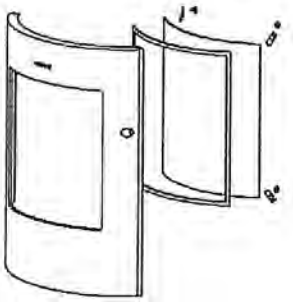
Replace broken glass immediately.
Do not operate your stove if the glass in the door is damaged.

If you need to replace the glass, it should be replaced with the high temperature ceramic class supplied by Morsø, contact your Morsø dealer.

Installing the glass

Never install the glass when the stove is in function.



1. When you open the door, you will find two hinge pins, one in each hinge. Remove the two hinge pins, lift the door off the hinges and place it face down on a sheet of cardboard or other nonabrasive fabric.

2. Unscrew the 4 bolts that secure the glass. (In the event that a bolt sheers off when being unscrewed, remove the remaining body of the bolt by drilling down its centre with 1/8 inch high speed steel drill bit. Smaller drill bits may be successful, but do not use a lager bit. Make sure the bit stays away from the edges of the bolt - this may damage the thread in the cast iron).

3. Remove the old ceramic gaskets and clean up the surface underneath with wire wool or emery paper to remove loose particles.

4. Place the new gasket material in position around the perimeter of the window area, making sure to pinch them to the length in such a way that they make a continuous seal. Leave no gaps.

5. Place the new glass in position on the strips and screw home the fresh bolts and fitting by hand.

6. Finally, give each of the bolts an extra half turn or so. The glass should held tight enough by that cleaning will not dislodge it. Do not over-tighten the bolts as this may put excessive pressure on the glass, resulting in cracking - important!

To reduce the risk of breaking the glass, avoid striking the glass or slamming the door.

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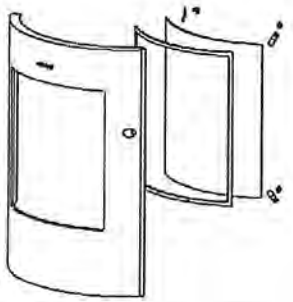

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To reduce the risk of breaking the glass, avoid striking the glass or slamming the door.

Internal service parts
The flame-path equipment - consisting of the ashpan, grate, firebricks, Cast iron fire plates, glass, baffle and flue collar - are subject to the extremes of heat produced by the fire. From time to time, one or other of these parts may need replacing as a matter of routine maintenance.

NOTE: The flame-path equipment, the ceramic rope and the paint finish are not covered by guarantee.

All of these service parts can be bought from your morsø dealer, and we recommend that damaged parts are replaced as soon as possible to avoid collateral damage.
Should the baffle be distorted by an overfire, the stove will still function, although its efficiency may be compromised. Replace it as soon as possible.

Reasons for fast internal wear and tear
Persistent heavy firing
Soot and ashes left to accumulate

Gasket
The gasket around the perimeter of the door may harden over a period of time. It should be replaced if it becomes difficult to close the doors or if air starts to leak in around the perimeter of the doors, causing the fire to become a little less controllable. A morsø rope gasket kit is available from your stove supplier.

3.3 Cleaning the Stove and the Flue

Check for soot above the baffle plate and around the flue outlet every month or so to start with. If the stove suddenly becomes sluggish, check for a soot fall around the flue collar or in the flue/chimney.

The chimney and chimney connector should be inspected at least once every two months during the heating season to determine if a creosote buildup has occurred. If creosote has accumulated, it should be removed to reduce the risk of a chimney fire.

Clean the flue/chimney - all the way from the stove to the flue terminal point above the house.

A good routine is to clean the flue after each heating season in any case, and inspect prior to the season to ensure that bird's nests or other blockages have not occurred during the off season.

Ash disposal
Empty the ashpan on a daily basis or as needed. Ash allowed to build up towards the underside of the grate will trap heat and could cause premature failure of the grate.

Empty the ashpan according to this procedure:
Open the front door, and use a shovel or poker to stir excess ash through the ash slots in the grate down into the ash pan. Take out the ash pan, making sure to keep it level to avoid spilling ash.

Dispose the ash in a metal container with a tight fitting lid.

The closed container of ashes should be placed on a noncombustible floor or on the ground, well away from all combustible materials, pending final disposal. If the ashes are disposed of

by burial in soil or otherwise locally disperded, they should be retained in the closed container until all cinders have thoroughly cooled.

Return the ash pan to its original position in the stove, and close the door.

Caution:
Never empty a stove in operation.
Never use your household or shop vacuum cleaner to remove ash from the stove; **always remove and dispose of the ash properly.**

Creosote - formation and need for removal

When wood is burned slowly, it produces tar and other organic vapors, which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cool chimney flue of a slow-burning fire. As a result, creosote residue accumulates on the flue lining. When ignited this creosote makes an extremely hot fire. When burning wood, the chimney and chimney connector should be inspected at least once every two months during the heating season to determine if a creosote buildup has occurred. If creosote has accumulated, it should be removed to reduce the risk of a chimney fire.

Chimney sweeping

Inspect the system regularly during the heating season as part of a regular maintenance schedule. To inspect the chimney, let the stove cool completely. Then, using a mirror, sight up through the flue collar into the chimney flue. If you cannot inspect the flue system in this fashion, the stove must be disconnected to provide better viewing access.

Clean the chimney using a brush the same size and shape as the flue liner. Run the brush up and down the liner, causing any deposits to fall to the bottom of the chimney where they can be removed through the clean-out door.

Clean the chimney connector disconnecting the sections, taking them outside, and removing any deposits with a stiff wire brush. Reinstall the connector sections after cleaning, being sure to secure the joints between individual sections with sheet metal screws.

If you cannot inspect or clean the chimney yourself, contact your local Morsø Dealer or a professional chimney sweep.

If you do experience a chimney fire, act promptly and:

Close the air control.
Get everyone out of the house.
Call the Fire Department.

Annual maintenance

Before the heating season, perform a thorough cleaning, inspection and repair:
Thoroughly clean the chimney and chimney connector.
Inspect the chimney for damage and deterioration. Replace weak sections of prefabricated chimney. Have a mason make repairs to a masonry chimney.
Inspect the chimney connector and replace any damaged sections.
Check gasketing for wear or compression, and replace if necessary.
Check the glass for cracking; replace if needed.
Check door and handle for tightness. Adjust if needed.

How to clean the inside parts of Morsø 8100

When cleaning the inside parts of the stove in connection with the annual visits from your local chimney sweep we recommend that you remove the inside parts from the fire chamber. Please be careful as the vermiculite parts are porous. Cleaning of the stove must be done when the stove is cold.

1. The bottom baffle is lifted up a bit and held in that position. Loosen the side bricks.

2. Tip the side bricks and remove them from the fire chamber.

3. Tip the other side brick and remove it from the fire chamber.

4 When the side bricks are removed the bottom baffle is lowered and lifted out of the fire chamber.

5. The upper baffle is removed from the brackets and lifted out of the firechamber.

3.4 Leaving the stove for extended periods

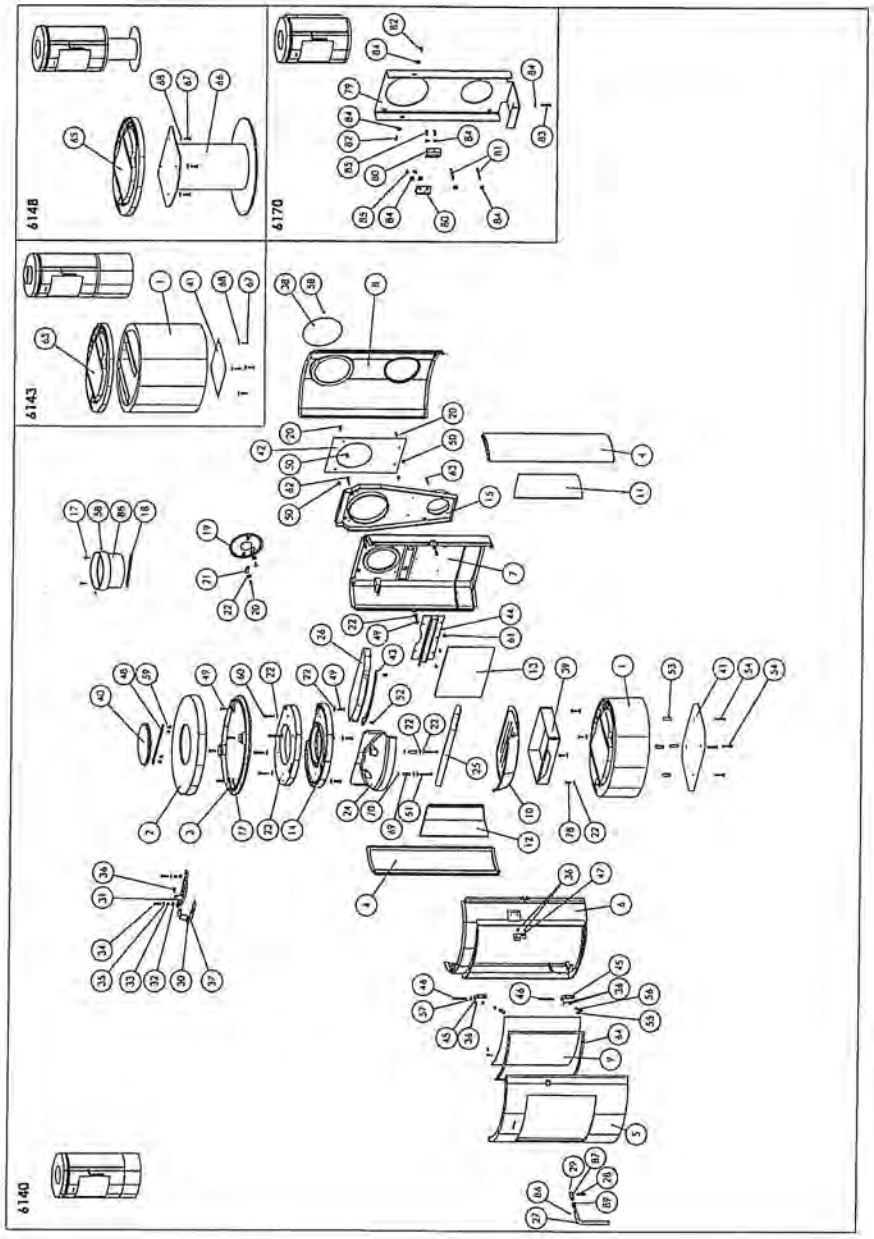
Important:

If the stove is to be left unused for any period of time, clean it out thoroughly and leave the air control slightly open to allow airflow. Make sure that the flue does not allow rainwater to come anywhere near the stove; install a chimney cap, but do not block off the flue completely.
These measures should ensure there is a slight movement of air through the stove, and that the body of the stove remains dry, right into the corners.
Any ash left within an unfired stove can attract moisture like blotting paper. If moisture is allowed to settle within the stove, rust will form. Rust expands as it takes a grip. This can lead to undue pressure on the stove joints, and this in turn may result in damage to the stove.

NOTE: It is best to thoroughly clean the stove after the heating season has concluded. Adding a dessicant, such as kitter litter, into the ash pan helps absorb moisture during the summer months. Be sure to remove this prior to the heating season.

We hope you have many years of carefree warmth in its company. Some initial experimentation with loading and running techniques will decide your normal routine. If you have any problems after this short learning phase, please refer to your stove dealer. Should they be unable to help for any reason, please contact us in writing at the address on the front of this publication.

3.5 Parts diagram for model Morsø 6100



3.6 Parts list for model Morsø 6100

Posnr.	Parts:	6170 NA
1	Socle	%
2	Top plate, outside	446109xx
3	Top frame	346106xx
4	Side plate, outside	346107xx
5	Door	446103xx
6	Front frame	446102xx
7	Rear plate, inside	446104xx
8	Rear plate, outside	446124xx
9	Glass	79610100
10	Intermediate frame	346110
11	Brick, side, right	79610200
12	Brick, side, left	79610300
13	Brick, back	79610400
14	Top plate, inside	44610500
15	Air canal, rear	44612500
16	Flue collar	%
17	Screw	%
18	Stop bar	%
19	Cover	441410xx
20	Screw	731616
21	Lug	44256800
22	Washer	791891
23	Air canal, top	446113xx
24	Air canal, front	446116xx
25	Baffle plate, lower	79610500
26	Baffle plate, top	79610600
27	Handle	75610061
28	Hinge pin	542056
29	Screw	73950500
30	Handle f. sek. draught control	71611261
31	Sek. draught control	71611100
32	Distance tube	71810300
33	Distance tube	71810200
34	Screw	74162000
35	Washer	736106
36	Screw	73851100
37	Closing plate for sek. draught control	71610800
38	Roundel	716110xx
39	Ash can	71610100
40	Cover	448120xx
41	Radiant shielding, bottom	%
42	Radiant shielding, rear	71612200
43	Fitting plate for baffle	71610461
44	Tertiary box	71610561
45	Hinge fitting	718101xx
46	Screw	74701000

Posnr.	Parts:	6170 NA
47	Closing fitting	71610700
48	Lug for cover	71813200
49	Screw	731625
50	Distance tube	541439
51	Screw	731650
52	Screw	731612
53	Distance tube	%
54	Screw	%
55	Glass fitting	71814561
56	Screw	742508
57	Washer	746006
58	Screw	791835
59	Screw	731608
60	Screw	731640
61	Screw	74361000
62	Screw	731635
63	Screw	731630
64	Tape for glass	79074200
65	Bottom plate	446126xx
66	Pedestal	%
67	Screw	%
68	Washer	%
69	Distance tube	541440
70	Washer	746206
71	Flue collar	441419xx
72	Stop bar	71611800
75	Spring	%
76	Screw	%
77	Washer	736210
78	Screw	731620
79	Fitting for wall	716120xx
80	Fitting for fitting for wall	716121xx
81	Screw	73166000
82	Screw	73861400
83	Screw	731635
84	Washer	791891
85	Screw	731612
86	Cotter pin	74201900
87	Axle f. door	75610161
88	Flue collar	446118xx
89	Spring	79048800

Section 4

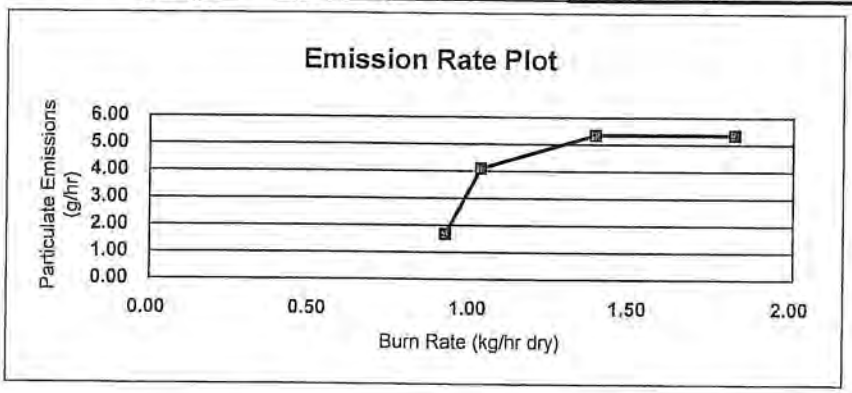
Test Data by Run

EPA Weighted Average Emissions
EPA Method 28

Client: Morso
Stove Model: 6100 Series
Test Dates: November 1 - November 2, 2007
Project Number: 192-S-15-3
Tracking Number: 1120
Signature/Date: BCL 11-7-07

Status: Final
Stove Type: Non-Catalytic Stove

Weighted Average (g/hr)
4.1



Run #	2	
Burn Rate (dry kg/hr)	0.92	
Catagory	2	
Overall Efficiency (%)	63%	
Emissions (g/hr)	1.68	
Cap (g/hr)	15	
Weighting Factor	0.396	25.29%
Heat Output (BTU/hr)	11117	

Run #	1	
Burn Rate (dry kg/hr)	1.03	
Catagory	2	
Overall Efficiency (%)	63%	
Emissions (g/hr)	4.09	
Cap (g/hr)	15	
Weighting Factor	0.376	23.98%
Heat Output (BTU/hr)	12446	

Run #	3	
Burn Rate (dry kg/hr)	1.39	
Catagory	3	
Overall Efficiency (%)	63%	
Emissions (g/hr)	5.35	
Cap (g/hr)	15	
Weighting Factor	0.482	30.74%
Heat Output (BTU/hr)	16796	

Run #	4	
Burn Rate (dry kg/hr)	1.82	
Catagory	3	
Overall Efficiency (%)	63%	
Emissions (g/hr)	5.34	
Cap (g/hr)	18	
Weighting Factor	0.313	19.99%
Heat Output (BTU/hr)	21992	

Run 1

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Manufacturer: Morso
Model: 6100 Series
Project No.: 1120
Tracking No.: 192-S-15-3
Run: 1
Test Date: 11/01/07

Burn Rate	1.03 kg/hr dry
Particulate Concentration (dry-standard) Particulate Emission Rate Adjusted Emissions	0.00031 grams/dscf 2.65 grams/hour 4.09 grams/hour
Average Tunnel Temperature	97 degrees Fahrenheit
Average Delta p	0.038 inches H20
Total Sample Volume - Vm Average Gas Meter Temperature Average Gas Velocity in Dilution Tunnel - vs Average Gas Flow Rate in Dilution Tunnel - Qsd Total Sample Volume (Standard Conditions) - Vmst	57.03 cubic feet 75 degrees Fahrenheit 13.18 feet/second 8556.64 dscf/hour 56.11 dscf
Total Particulates - mn Average Delta H Total Time of Test	17.4 mg 0.82 inches H20 110 minutes

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Run: 1

Manufacturer:	Morso		
Model:	6100 Series		
Tracking No.:	1120		
Project No.:	192-S-15-3		
Test Date:	01-Nov-07		
Beginning Clock Time:	11:07		
Recording Interval:	10	min.	
Total Sampling Time:	110	min.	

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
Initial dP	0.035	0.038	0.045	0.043	0.030	0.035	0.040	0.035	"H2O
Initial Temp.	94	94	94	94	94	94	94	94	oF

OMNI Equipment Numbers: _____

PM Control Module:	322		
Dilution Tunnel MW(dry):	29.00	lb/lb-mole	
Dilution Tunnel MW(wet):	28.56	lb/lb-mole	
Dilution Tunnel H2O:	4.00	percent	
Dilution Tunnel Static:	-0.630	"H2O	
Pitot Tube Cp:	0.99		
Meter Box Y Factor:	0.983		

Barometric Pressure:	Begin	Middle	End	Average
	30.28	30.28	30.27	30.28 "Hg

Signature/Date: R.J. Morgo 11-15-07

Tunnel Velocity:	13.18	ft/sec.
Intial Tunnel Flow:	142.7	scfm
Average Tunnel Flow:	142.6	scfm
Tunnel Area:	0.196	ft2
Post-Test Leak Check:	.007 @ 5	cfm@"Hg
Fuel Moisture (dry basis	19.87	%
Total Particulate:	17.4	mg
Filter Holder No.:	A	

Elapsed Time	Particulate Sampling Data								Fuel Weight, lb		Wood Heater Temperature Data, oF											Stack	
	Gas Meter Cubic Feet	Sample Rate, cfm	Orifice dH	Meter oF	Meter Vac. In. Hg.	Dilution Tunnel Temp.	Dilution Tunnel dP	Pro. Rate (10%)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Filter	Impinger exit	Ambient	Draft In. H2O	Catalyst Temp.
0	0.000		0.00	66	0	94	0.038		5.0		467	459	287	497	486		439.2	321	73	63	65	-0.037	
10	5.130	0.51	0.88	67	1	98	0.038	101	4.3	-0.7	418	516	271	441	425		414.2	272	77	49	65	-0.043	
20	10.169	0.50	0.88	69	1	102	0.038	99	3.1	-1.2	440	471	255	417	426		401.8	368	79	44	66	-0.050	
30	15.233	0.51	0.89	71	1	102	0.038	100	2.0	-1.1	486	432	267	449	470		420.8	353	80	43	67	-0.048	
40	20.415	0.52	0.89	73	1	101	0.038	101	1.1	-0.9	528	401	285	488	511		442.6	336	81	43	70	-0.045	
50	25.619	0.52	0.90	76	1	99	0.038	101	0.8	-0.3	531	266	297	497	521		422.4	294	80	42	66	-0.038	
60	30.837	0.52	0.90	77	1	97	0.038	101	0.6	-0.2	505	396	294	488	508		438.2	269	79	43	67	-0.035	
70	36.069	0.52	0.90	78	1	96	0.038	101	0.5	-0.1	464	409	284	471	488		423.2	249	80	43	67	-0.033	
80	41.294	0.52	0.90	80	1	94	0.038	100	0.4	-0.1	422	412	272	450	465		404.2	233	79	43	66	-0.033	
90	46.553	0.53	0.90	80	1	94	0.038	101	0.2	-0.2	391	403	261	433	444		386.4	221	78	43	67	-0.030	
100	51.784	0.52	0.90	81	1	92	0.038	100	0.1	-0.1	371	398	254	422	428		374.6	216	79	43	68	-0.030	
110	57.030	0.52	0.90	81	1	92	0.038	100	0.0	-0.1	354	397	247	411	412		364.2	210	78	46	69	-0.028	
Avg/Total	57.030	0.52	0.82	74.92		96.75	0.038	100.63									75		78.58	45.42		-0.038	#DIV/0!

Final Laboratory Report - Method 5G
Dilution Tunnel Particulate Calculations

Client Name: Morso
Model: 6100 Series
Project No.: 192-S-15-3
Tracking No.: 1120
Equipment Numbers:
Run #: 1
Date: 11/01/07

Sample Component	Reagent	Filter # or Volume, ml	Weights			
			Final, mg	Tare, mg	Blank, mg/ml	Particulate, mg
A. Front filter catch	Filter	N455	600.9	585.0		15.9
B. Rear filter catch	Filter	N454	571.3	571.6		-0.3
C. Rinse of probe and filter assembly	Acetone	100	108372.4	108368.9	0.0173	1.8

Total Particulate, mg :	17.4

Component	Equations:
A. Front filter catch	Final (mg) - Tare (mg) = Particulate, mg
B. Rear filter catch	Final (mg) - Tare (mg) = Particulate, mg
C. Rinse of probe and filter assembly	(Final, mg - Tare, mg) - (Blank, mg/ml x Volume, ml) = Particulate, mg

Analyst: [signature] Date: 11-7-07

Wood Heater Test Data - EPA Method 5G Preburn

Run: 1

Manufacturer: Morso
Model: 6100 Series
Tracking No.: 1120
Project No.: 192-S-15-3
Preburn Date: 39387

Recording Interval: 10 min.

Coal Bed Range: 1.0 - 1.2
Actual Coal Bed: 1

Signature/Date: [signature] 11-26-07

OMNI Equipment Numbers:

Elapsed Time	Fuel Weight, lb		Wood Heater Temperature Data, oF									Stack	
	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Ambient	Draft In. H2O	Catalyst Temp.
0	4.8		365	444	221	393	363	0	357.2	356	64	-0.045	NA
10	4	-0.8	380	415	228	404	392	0	363.8	333	64	-0.045	NA
20	3.1	-0.9	412	389	244	422	438	0	381.0	330	65	-0.043	NA
30	2.3	-0.8	453	375	263	457	478	0	405.2	341	66	-0.045	NA
40	1.6	-0.7	477	382	276	485	498	0	423.6	330	66	-0.043	NA
50	1.2	-0.4	483	424	285	504	497	0	438.6	297	66	-0.040	NA
60	1	-0.2	470	451	284	499	490	0	438.8	283	66	-0.038	NA
Avg/Total													

OMNI-Test Laboratories, Inc.
Beaverton, OR

FUEL DATA

Client: Morso
Model: 6100 Series
Project #: 192-S-15-3 Tracking #: 1120
Date: 11-01-07 Test Crew: K. Morgan Run #: 1
OMNI Equipment ID #:
FUEL LOAD PREPARED BY: K. Morgan
FUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER, DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER – – DRY BASIS)

CALIBRATION: Cal Value (1) = 12% Actual Reading 12.0
Cal Value (2) = 22% Actual Reading 22.0

Piece	Length		Readings		Type
1	8 ft	23.7	22.8	23.4	2x4
2	ft				
3	ft				

Length of cut pieces: 4@10 1/4", 2@8 1/4" inches Pre-Burn Fuel Average Moisture: 23.3%

Time (clock): 09:35 Room Temperature (F): 63 Initials: K

TEST FUEL

FUEL TYPE AND AMOUNT: 2 × 4 3 4 × 4 0
CALCULATED LOAD WEIGHT: 5.208 lb. ACTUAL LOAD WEIGHT: 5.0 (2 × 4)
0 (4 × 4)
FUEL PIECE LENGTH: 11.0" 5.0 Total

MOISTURE CONTENT (METER – – DRY BASIS)

PIECE	READINGS			TYPE
1	18.6	19.7	21.7	2 x 4
2	18.9	19.9	20.9	2 x 4
3	19.1	19.0	21.0	2 x 4
4				
5				
6				
7				
8				
9				
10				

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 19.87%

Time (clock): 09:40 Room Temperature (F): 63 Initials: K

Technician signature: K. Morgan Date: 11-01-07

OMNI-Test Laboratories, Inc.
Beaverton, OR

PRELIMINARY: 1.03 @ 4.3

Run Notes

Client: Morso
Model: 6100 Series
Project #: 192-S-15-3
Tracking #: 1120
Run #: 1 Date: 11-01-07
Test Crew: K. Morgan
OMNI Equipment ID #(s): _____

PREBURN

DESCRIBE OR SKETCH AIR OR THERMOMSTAT SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCABLE)

PRIMARY:

OPEN ~~0.4375"~~ 0.375" IL

SECONDARY: FIXED

TERTIARY: NONE

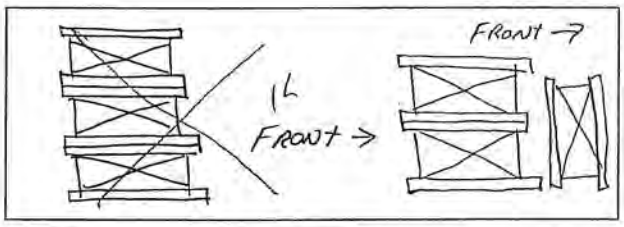
FAN: NONE

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
0	test setting					
60					X	Levelled

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)



START UP PROCEDURES

BYPASS: N/A
FUEL LOADING: Loaded by 60 sec.
DOOR: AJAR until 3.0 min.
PRIMARY AIR: Full open 5.0 min. - Abruptly Adjusted to test setting at 5.0 min.
OTHER: NONE.

DESCRIBE OR SKETCH TEST SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)
PRIMARY:

SAME AS ABOVE

SECONDARY: FIXED

TERTIARY: NONE

FAN: NONE

Technician signature: K. J. Morgan Date: 11-01-07

OMNI-Test Laboratories, Inc.
Beaverton, OR

Supplemental Data EPA 5G/5H

Client: Morso

Model: 6100 Series

Project #: 192-S-15-3 Tracking #: 1120

Date: 11-01-07 Run #: 1 Booth: 1

Test Crew: K. Morgan Start Time: 11:07 Stop Time: 12:57

OMNI Equipment #(s): _____

Gas Analyzer Train Leak Check:

Stack: Dilution Tunnel (Method 5G Only):

Initial: _____ Initial: _____

Final: N/A Final: N/A

Calibrations: Span Gas CO_2: N/A O_2: N/A CO: N/A CO_2(DT): N/A

	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span
Time							
O_2							
CO_2			N/A				
CO							
CO_2 (DT)							

Stack Diameter (inches): 6.0

Air Velocity (ft/min): Initial: <50 Final: <50

Scale Audit (lbs): Pretest: 10.0 Post Test: 10.0

Induced Draft: 0 %Smoke Capture: 100

Pitot Tube Leak Test: Pre: 0 @ 3.1 "w.c. Post: 0 @ 3.1" w.c.

Flue Pipe Cleaned Prior to First Test in Series: Date: 10-31-07 Initials: K

	Initial	Middle	Ending
Pb (in/Hg)	30.28	30.28	30.27
Room Temp (°F)	65	66	69

Technician signature: K. Morgan Date: 11-01-07

Run 2

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Manufacturer: Morso
Model: 6100 Series
Project No.: 1120
Tracking No.: 192-S-15-3
Run: 2
Test Date: 11/01/07

Burn Rate	0.92 kg/hr dry
Particulate Concentration (dry-standard) Particulate Emission Rate Adjusted Emissions	0.00011 grams/dscf 0.91 grams/hour 1.68 grams/hour
Average Tunnel Temperature	96 degrees Fahrenheit
Average Delta p	0.037 inches H20
Total Sample Volume - Vm Average Gas Meter Temperature Average Gas Velocity in Dilution Tunnel - vs Average Gas Flow Rate in Dilution Tunnel - Qsd Total Sample Volume (Standard Conditions) - Vmst	62.88 cubic feet 80 degrees Fahrenheit 12.98 feet/second 8430.75 dscf/hour 61.30 dscf
Total Particulates - mn Average Delta H Total Time of Test	6.6 mg 0.83 inches H20 120 minutes

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Run: 2

Signature/Date: M.J. Morgan 11-15-07

Manufacturer:	Morso		
Model:	6100 Series		
Tracking No.:	1120		
Project No.:	192-S-15-3		
Test Date:	01-Nov-07		
Beginning Clock Time:	15:03		
Recording Interval:	10	min.	
Total Sampling Time:	120	min.	

OMNI Equipment Numbers: _____

Velocity Traverse Data									
	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
Initial dP	0.028	0.035	0.045	0.043	0.030	0.038	0.038	0.035	"H2O
Initial Temp.	97	97	97	97	97	97	97	97	oF

PM Control Module:	322		
Dilution Tunnel MW(dry):	29.00	lb/lb-mole	
Dilution Tunnel MW(wet):	28.56	lb/lb-mole	
Dilution Tunnel H2O:	4.00	percent	
Dilution Tunnel Static:	-0.630	"H2O	
Pitot Tube Cp:	0.99		
Meter Box Y Factor:	0.983		

Barometric Pressure:	Begin	Middle	End	Average
	30.27	30.27	30.27	30.27 "Hg

Tunnel Velocity:	12.98	ft/sec.
Intial Tunnel Flow:	140.0	scfm
Average Tunnel Flow:	140.5	scfm
Tunnel Area:	0.196	ft2
Post-Test Leak Check:	.006 @ 5	cfm@"Hg
Fuel Moisture (dry basis	20.64	%
Total Particulate:	6.6	mg
Filter Holder No.:	A	

Elapsed Time	Particulate Sampling Data								Fuel Weight, lb		Wood Heater Temperature Data, oF											Stack	
	Gas Meter Cubic Feet	Sample Rate, cfm	Orifice dH	Meter oF	Meter Vac. In. Hg.	Dilution Tunnel Temp.	Dilution Tunnel dP	Pro. Rate (10%)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Filter	Impinger exit	Ambient	Draft In. H2O	Catalyst Temp.
0	0.000		0.00	66	0	97	0.037		4.9		426	401	271	458	458		402.8	300	74	67	70	-0.035	
10	5.185	0.52	0.90	74	1	105	0.037	102	3.8	-1.1	412	434	259	426	424		391.0	349	76	46	70	-0.048	
20	10.457	0.53	0.90	75	1	102	0.037	103	2.9	-0.9	452	413	265	242	449		364.2	332	78	45	69	-0.048	
30	15.678	0.52	0.90	77	1	101	0.037	101	2.1	-0.8	488	374	276	432	481		410.2	318	78	44	69	-0.045	
40	20.897	0.52	0.90	79	1	101	0.037	101	1.3	-0.8	514	343	284	440	503		416.8	326	79	44	70	-0.045	
50	26.116	0.52	0.90	81	1	99	0.037	100	0.9	-0.4	530	322	294	459	516		424.2	294	78	45	67	-0.040	
60	31.359	0.52	0.90	82	1	96	0.037	100	0.7	-0.2	501	316	290	459	499		413.0	256	79	45	69	-0.035	
70	36.606	0.52	0.90	83	1	95	0.037	100	0.6	-0.1	461	323	279	447	477		397.4	238	78	45	68	-0.033	
80	41.866	0.53	0.90	83	1	93	0.037	100	0.5	-0.1	426	332	268	438	459		384.6	227	77	45	68	-0.030	
90	47.098	0.52	0.90	84	1	92	0.037	99	0.4	-0.1	404	341	262	432	448		377.4	221	77	45	67	-0.030	
100	52.353	0.53	0.90	84	1	90	0.037	100	0.3	-0.1	381	351	257	427	441		371.4	211	76	45	67	-0.028	
110	57.614	0.53	0.90	84	1	90	0.037	100	0.1	-0.2	369	356	253	424	435		367.4	209	76	45	67	-0.028	
120	62.878	0.53	0.90	84	1	90	0.037	100	0.0	-0.1	357	359	249	421	426		362.4	207	76	45	68	-0.028	
Avg/Total	62.878	0.52	0.83	79.69		96.23	0.037	100.55									40		77.08	46.62		-0.036	#DIV/0!

Final Laboratory Report - Method 5G
Dilution Tunnel Particulate Calculations

Client Name: Morso
Model: 6100 Series
Project No.: 192-S-15-3
Tracking No.: 1120
Equipment Numbers:
Run #: 2
Date: 11/01/07

Sample Component	Reagent	Filter # or Volume, ml	Weights			
			Final, mg	Tare, mg	Blank, mg/ml	Particulate, mg
A. Front filter catch	Filter	N457	584.4	578.8		5.6
B. Rear filter catch	Filter	N456	581.6	582.4		-0.8
C. Rinse of probe and filter assembly	Acetone	100	103043.1	103039.6	0.0173	1.8

Total Particulate, mg :	6.6

Component	Equations:
A. Front filter catch	Final (mg) - Tare (mg) = Particulate, mg
B. Rear filter catch	Final (mg) - Tare (mg) = Particulate, mg
C. Rinse of probe and filter assembly	(Final, mg - Tare, mg) - (Blank, mg/ml x Volume, ml) = Particulate, mg

Analyst: BJ Date: 11-7-07

Wood Heater Test Data - EPA Method 5G Preburn

Run: 2

Manufacturer: Morso
Model: 6100 Series
Tracking No.: 1120
Project No.: 192-S-15-3
Preburn Date: 39387

Recording Interval: 10 min.

Coal Bed Range: 1.0 - 1.2
Actual Coal Bed: 1.2

Signature/Date: M Morgan 11-26-07

OMNI Equipment Numbers:

Elapsed Time	Fuel Weight, lb		Wood Heater Temperature Data, oF									Stack	
	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Ambient	Draft In. H2O	Catalyst Temp.
0	4.9		298	399	210	352	345	0	320.8	309	67	-0.043	NA
10	4.4	-0.5	312	393	217	335	364	0	324.2	230	68	-0.035	NA
20	3.7	-0.7	329	385	220	335	362	0	326.2	296	68	-0.040	NA
30	3.1	-0.6	354	372	232	366	403	0	345.4	291	68	-0.040	NA
40	2.4	-0.7	397	353	251	414	457	0	374.4	297	67	-0.043	NA
50	1.8	-0.6	422	358	261	439	471	0	390.2	294	69	-0.040	NA
60	1.4	-0.4	432	364	265	450	470	0	396.2	290	69	-0.040	NA
70	1.2	-0.2	430	386	267	458	463	0	400.8	266	69	-0.035	NA
Avg/Total													

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OMNI-Test Laboratories, Inc.
Beaverton, OR

FUEL DATA

Client: Morso
Model: 6100 Series
Project #: 192-S-15-3 Tracking #: 1120
Date: 11-01-07 Test Crew: K. Morgan Run #: 2
OMNI Equipment ID #: _____
FUEL LOAD PREPARED BY: K. Morgan
FUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER, DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER – – DRY BASIS)

CALIBRATION: Cal Value (1) = 12% Actual Reading 12.0
Cal Value (2) = 22% Actual Reading 22.0

Piece	Length	Readings			Type
1	8 ft	22.3	19.8	23.4	2x4
2	____ ft	____	____	____	____
3	____ ft	____	____	____	____

Length of cut pieces: 2@8" 4@10" inches Pre-Burn Fuel Average Moisture: 21.83%

Time (clock): 13:30 Room Temperature (F): 67 Initials: IL

TEST FUEL

FUEL TYPE AND AMOUNT: 2 × 4 3 4 × 4 0
CALCULATED LOAD WEIGHT: 5.208 lb ACTUAL LOAD WEIGHT: 4.9 (2 × 4)
0 (4 × 4)
FUEL PIECE LENGTH: 11.0" 4.9 Total

MOISTURE CONTENT (METER – – DRY BASIS)

PIECE	READINGS			TYPE
1	22.5	19.7	19.3	2x4
2	20.4	18.9	22.5	2x4
3	22.7	19.3	20.5	2x4
4	____	____	____	____
5	____	____	____	____
6	____	____	____	____
7	____	____	____	____
8	____	____	____	____
9	____	____	____	____
10	____	____	____	____

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 20.64

Time (clock): 14:00 Room Temperature (F): 67 Initials: IL

Technician signature: K. J. Morgan Date: 11-01-07

Preliminary: 0.92 @ 1.66

OMNI-Test Laboratories, Inc.
Beaverton, OR

Run Notes

Client: Morso
Model: 6100 Series
Project #: 192-S-15-3
Tracking #: 1120
Run #: 2 Date: 11-01-07
Test Crew: K. Morgan
OMNI Equipment ID #(s):

PREBURN

DESCRIBE OR SKETCH AIR OR THERMOMSTAT SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCABLE)

PRIMARY:

Open 0.250"

SECONDARY: FIXED

TERTIARY: NONE

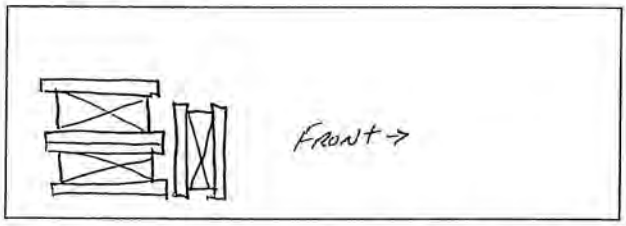
FAN: NONE

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
8 70	Test Setting				X	Levelled

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)



START UP PROCEDURES

BYPASS: N/A
FUEL LOADING: Loaded by 1.0 min
DOOR: AJAR until 3.0 min
PRIMARY AIR: Full open 5.0 min - Abruptly adjusted to test setting at 5.0 min.
OTHER: NONE

DESCRIBE OR SKETCH TEST SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)
PRIMARY:

SAME AS ABOVE

SECONDARY: FIXED

TERTIARY: NONE

FAN: NONE

Technician signature: K. Morgan Date: 11-01-07

OMNI-Test Laboratories, Inc.
Beaverton, OR

Supplemental Data EPA 5G/5H

Client: Morso

Model: 6100 Series

Project #: 192-S-15-3 Tracking #: 1120

Date: 11-01-07 Run #: 2 Booth: 1

Test Crew: K. Morgan Start Time: 15:03 Stop Time: 17:03

OMNI Equipment #(s): _____

Gas Analyzer Train Leak Check:

Stack:

Initial: _____

Final: N/A

Dilution Tunnel (Method 5G Only):

Initial: _____

Final: N/A

Calibrations: Span Gas CO_2: N/A O_2: N/A CO: N/A CO_2(DT): N/A

	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span
Time							
O_2			N/A				
CO_2							
CO							
CO_2 (DT)							

Stack Diameter (inches): 61.0

Air Velocity (ft/min): Initial: <50 Final: <50

Scale Audit (lbs): Pretest: 10.0 Post Test: 10.0

Induced Draft: Ø %Smoke Capture: 100

Pitot Tube Leak Test: Pre: Ø @ 3.1" w.c. Post: Ø @ 3.2" w.c.

Flue Pipe Cleaned Prior to First Test in Series: Date: 10-31-07 Initials: IC

	Initial	Middle	Ending
Pb (in/Hg)	30.27	30.27	30.27
Room Temp (°F)	70	67	68

Technician signature: K. Morgan Date: 11-01-07

Run 3

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Manufacturer: Morso
Model: 6100 Series
Project No.: 1120
Tracking No.: 192-S-15-3
Run: 3
Test Date: 11/02/07

Burn Rate	1.39 kg/hr dry
Particulate Concentration (dry-standard) Particulate Emission Rate Adjusted Emissions	0.00042 grams/dscf 3.66 grams/hour 5.35 grams/hour
Average Tunnel Temperature	102 degrees Fahrenheit
Average Delta p	0.039 inches H20
Total Sample Volume - Vm Average Gas Meter Temperature Average Gas Velocity in Dilution Tunnel - vs Average Gas Flow Rate in Dilution Tunnel - Qsd Total Sample Volume (Standard Conditions) - Vms	42.00 cubic feet 74 degrees Fahrenheit 13.47 feet/second 8681.57 dscf/hour 41.48 dscf
Total Particulates - mn Average Delta H Total Time of Test	17.5 mg 0.80 inches H20 80 minutes

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Run: 3

Manufacturer:	Morso
Model:	6100 Series
Tracking No.:	1120
Project No.:	192-S-15-3
Test Date:	02-Nov-07
Beginning Clock Time:	11:32
Recording Interval:	10 min.
Total Sampling Time:	80 min.

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
Initial dP	0.035	0.038	0.043	0.040	0.030	0.038	0.048	0.040	"H2O
Initial Temp.	102	102	102	102	101	101	101	101	oF

OMNI Equipment Numbers: _____

PM Control Module:	322			
Dilution Tunnel MW(dry):	29.00	lb/lb-mole		
Dilution Tunnel MW(wet):	28.56	lb/lb-mole		
Dilution Tunnel H2O:	4.00	percent		
Dilution Tunnel Static:	-0.700	"H2O		
Pitot Tube Cp:	0.99			
Meter Box Y Factor:	0.983			
Barometric Pressure:	Begin	Middle	End	Average
	30.33	30.33	30.33	30.33 "Hg

Signature/Date: M. Morg 11-15-07

Tunnel Velocity:	13.47	ft/sec.
Intial Tunnel Flow:	144.4	scfm
Average Tunnel Flow:	144.7	scfm
Tunnel Area:	0.196	ft2
Post-Test Leak Check:	.007 @ 6	cfm@"Hg
Fuel Moisture (dry basis	22.51	%
Total Particulate:	17.5	mg
Filter Holder No.:	A	

Elapsed Time	Particulate Sampling Data								Fuel Weight, lb		Wood Heater Temperature Data, oF											Stack	
	Gas Meter Cubic Feet	Sample Rate, cfm	Orifice dH	Meter oF	Meter Vac. In. Hg.	Dilution Tunnel Temp.	Dilution Tunnel dP	Pro. Rate (10%)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Filter	Impinger exit	Ambient	Draft In. H2O	Catalyst Temp.
0	0.000		0.00	68	0	102	0.039		5.0		444	532	283	504	489		450.4	314	72	64	67	-0.041	
10	5.173	0.52	0.90	69	1	99	0.039	100	4.2	-0.8	393	550	262	455	433		418.6	348	73	45	67	-0.053	
20	10.375	0.52	0.90	71	1	104	0.039	101	2.7	-1.5	449	491	257	483	462		428.4	420	76	42	69	-0.055	
30	15.585	0.52	0.90	72	1	106	0.039	101	1.5	-1.2	512	470	274	539	515		462.0	419	77	42	69	-0.055	
40	20.848	0.53	0.90	74	1	106	0.039	101	0.7	-0.8	561	468	301	586	564		496.0	396	79	42	68	-0.053	
50	26.133	0.53	0.90	76	1	102	0.039	101	0.5	-0.2	545	489	313	584	564		499.0	345	79	41	68	-0.048	
60	31.432	0.53	0.90	77	1	100	0.039	101	0.3	-0.2	501	512	303	559	538		482.6	319	78	42	67	-0.043	
70	36.780	0.53	0.90	78	1	98	0.039	102	0.1	-0.2	448	522	284	524	505		456.6	296	78	42	68	-0.043	
80	42.000	0.52	0.90	79	1	97	0.039	99	0.0	-0.1	419	523	275	504	488		441.8	285	77	43	69	-0.040	
Avg/Total	42.000	0.53	0.80	73.78		101.50	0.039	100.63									9		76.56	44.78		-0.048	#DIV/0!

OMNI-Test Laboratories, Inc.

Final Laboratory Report - Method 5G
Dilution Tunnel Particulate Calculations

Client Name: Morso
Model: 6100 Series
Project No.: 192-S-15-3
Tracking No.: 1120
Equipment Numbers:
Run #: 3
Date: 11/02/07

Sample Component	Reagent	Filter # or Volume, ml	Weights			
			Final, mg	Tare, mg	Blank, mg/ml	Particulate, mg
A. Front filter catch	Filter	N459	599.8	583.1		16.7
B. Rear filter catch	Filter	N458	580.1	580.9		-0.8
C. Rinse of probe and filter assembly	Acetone	100	111497.8	111494.5	0.0173	1.6

Total Particulate, mg :	17.5

Component	Equations:
A. Front filter catch	Final (mg) - Tare (mg) = Particulate, mg
B. Rear filter catch	Final (mg) - Tare (mg) = Particulate, mg
C. Rinse of probe and filter assembly	(Final, mg - Tare, mg) - (Blank, mg/ml x Volume, ml) = Particulate, mg

Analyst: [signature] Date: 11-7-07

Wood Heater Test Data - EPA Method 5G Preburn

Run: 3

Manufacturer: Morso
Model: 6100 Series
Tracking No.: 1120
Project No.: 192-S-15-3
Preburn Date: 39388

Recording Interval: 10 min.

Coal Bed Range: 1.0 - 1.2
Actual Coal Bed: 1

Signature/Date: 11-26-07

OMNI Equipment Numbers:

Elapsed Time	Fuel Weight, lb		Wood Heater Temperature Data, oF									Stack	
	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Ambient	Draft In. H2O	Catalyst Temp.
0	8		437	566	272	486	474	0	447.0	294	65	-0.040	NA
10	7.7	-0.3	380	527	250	430	418	0	401.0	228	65	-0.033	NA
20	7	-0.7	333	462	216	384	353	0	349.6	311	65	-0.045	NA
30	6.2	-0.8	335	452	214	380	350	0	346.2	339	66	-0.048	NA
40	5	-1.2	368	425	215	415	386	0	361.8	396	65	-0.055	NA
50	3.7	-1.3	447	416	240	480	451	0	406.8	426	66	-0.055	NA
60	2.5	-1.2	521	454	284	542	523	0	464.8	412	66	-0.055	NA
70	1.8	-0.7	547	499	308	568	555	0	495.4	384	68	-0.050	NA
80	1.4	-0.4	531	525	311	565	553	0	497.0	354	67	-0.048	NA
90	1.2	-0.2	496	532	300	536	530	0	478.8	319	66	-0.043	NA
100	1	-0.2	452	527	283	505	498	0	453.0	301	69	-0.043	NA
Avg/Total													

OMNI-Test Laboratories, Inc.
Beaverton, OR

FUEL DATA

Client: Morso
Model: 6100 Series
Project #: 192-S-15-3 Tracking #: 1120
Date: 11-02-07 Test Crew: K. Morgan Run #: 3
OMNI Equipment ID #: _____
FUEL LOAD PREPARED BY: K. Morgan
FUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER, DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER – – DRY BASIS)

CALIBRATION: Cal Value (1) = 12% Actual Reading 12.0
Cal Value (2) = 22% Actual Reading 22.0

Piece	Length		Readings		Type
1	8 ft	23.7	22.6	22.6	2x4
2	____ ft				
3	____ ft				

Length of cut pieces: 4@8" 4@10" inches Pre-Burn Fuel Average Moisture: 22.97%

Time (clock): 09:30 Room Temperature (F): 65 Initials: K

TEST FUEL

FUEL TYPE AND AMOUNT: 2 × 4 3 4 × 4 0
CALCULATED LOAD WEIGHT: 5.208 lb. ACTUAL LOAD WEIGHT: 5.0 (2 × 4)
0 (4 × 4)
FUEL PIECE LENGTH: 11.0" 5.0 Total

MOISTURE CONTENT (METER – – DRY BASIS)

PIECE	READINGS			TYPE
1	24.5	20.6	21.3	2x4
2	23.8	21.2	22.7	2x4
3	20.9	22.8	24.8	2x4
4				
5				
6				
7				
8				
9				
10				

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 22.51%

Time (clock): 09:30 Room Temperature (F): 65 Initials: K

Technician signature: K. Morgan Date: 11-02-07

OMNI-Test Laboratories, Inc.
Beaverton, OR

PRELIMINARY: 1,39 @ 5.72

Run Notes

Client: Morso
Model: 6100 Series
Project #: 192-S-15-3
Tracking #: 1120
Run #: 3 Date: 11-02-07
Test Crew: K. Morgan
OMNI Equipment ID #(s):

PREBURN

DESCRIBE OR SKETCH AIR OR THERMOMSTAT SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCABLE)

PRIMARY:

Full OPEN

SECONDARY: FIXED

TERTIARY: NONE

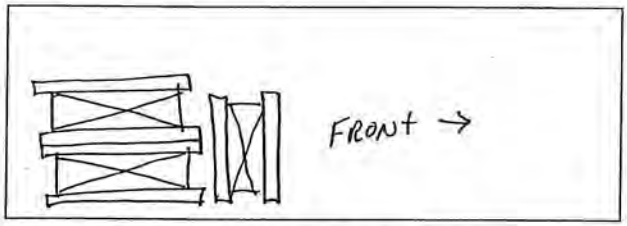
FAN: NONE

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
0	test setting					
35					X	ADJUST
110					X	Levelled

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)



START UP PROCEDURES

BYPASS: N/A
FUEL LOADING Loaded by 40 sec.
DOOR: Closed at 50 sec.
PRIMARY AIR: Full open Duration of test.
OTHER: NONE

DESCRIBE OR SKETCH TEST SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)
PRIMARY:

SAME AS ABOVE

SECONDARY: FIXED

TERTIARY: NONE

FAN: NONE

Technician signature: K. J. Morgan Date: 11-02-07

OMNI-Test Laboratories, Inc.
Beaverton, OR

Supplemental Data EPA 5G/5H

Client: Morso

Model: 6100 Series

Project #: 192-S-15-3 Tracking #: 1120

Date: 11-02-07 Run #: 3 Booth: 1

Test Crew: K. Morgan Start Time: 11:32 Stop Time: 13:02

OMNI Equipment #(s): _____

Gas Analyzer Train Leak Check:

Stack: Initial: _____ Final: N/A

Dilution Tunnel (Method 5G Only): Initial: _____ Final: N/A

Calibrations: Span Gas CO_2: N/A O_2: N/A CO: N/A CO_2(DT): N/A

	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span
Time							
O_2							
CO_2			N/A				
CO							
CO_2 (DT)							

Stack Diameter (inches): 6.0

Air Velocity (ft/min): Initial: <50 Final: <50

Scale Audit (lbs): Pretest: 10.0 Post Test: 10.0

Induced Draft: Ø %Smoke Capture: 100

Pitot Tube Leak Test: Pre: Ø @ 3.2" w.c. Post: Ø @ 3.0" w.c.

Flue Pipe Cleaned Prior to First Test in Series: Date: 10-31-07 Initials: K

	Initial	Middle	Ending
Pb (in/Hg)	30.33	30.33	30.33
Room Temp (°F)	67	68	69

Technician signature: K. J. Morgan Date: 11-02-07

Run 4

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Manufacturer: Morso
Model: 6100 Series
Project No.: 1120
Tracking No.: 192-S-15-3
Run: 4
Test Date: 11/02/07

Burn Rate	1.82 kg/hr dry
Particulate Concentration (dry-standard) Particulate Emission Rate Adjusted Emissions	0.00042 grams/dscf 3.66 grams/hour 5.34 grams/hour
Average Tunnel Temperature	109 degrees Fahrenheit
Average Delta p	0.041 inches H20
Total Sample Volume - Vm Average Gas Meter Temperature Average Gas Velocity in Dilution Tunnel - vs Average Gas Flow Rate in Dilution Tunnel - Qsd Total Sample Volume (Standard Conditions) - Vmst	31.60 cubic feet 78 degrees Fahrenheit 13.83 feet/second 8780.21 dscf/hour 30.94 dscf
Total Particulates - mn Average Delta H Total Time of Test	12.9 mg 0.77 inches H20 60 minutes

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Run: 4

Manufacturer:	Morso
Model:	6100 Series
Tracking No.:	1120
Project No.:	192-S-15-3
Test Date:	02-Nov-07
Beginning Clock Time:	14:43
Recording Interval:	10 min.
Total Sampling Time:	60 min.

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
Initial dP	0.035	0.045	0.045	0.043	0.035	0.038	0.043	0.040	"H2O
Initial Temp.	107	107	107	107	106	106	106	106	oF

OMNI Equipment Numbers:

PM Control Module:	322
Dilution Tunnel MW(dry):	29.00 lb/lb-mole
Dilution Tunnel MW(wet):	28.56 lb/lb-mole
Dilution Tunnel H2O:	4.00 percent
Dilution Tunnel Static:	-0.670 "H2O
Pitot Tube Cp:	0.99
Meter Box Y Factor:	0.983

Barometric Pressure:

Begin	Middle	End	Average
30.30	30.29	30.28	30.29 "Hg

Signature/Date: N. J. Morgan 11-15-07

Tunnel Velocity:	13.83 ft/sec.
Intial Tunnel Flow:	146.5 scfm
Average Tunnel Flow:	146.3 scfm
Tunnel Area:	0.196 ft2
Post-Test Leak Check:	.007 @ 6 cfm@"Hg
Fuel Moisture (dry basis	22 %
Total Particulate:	12.9 mg
Filter Holder No.:	A

Elapsed Time	Particulate Sampling Data								Fuel Weight, lb		Wood Heater Temperature Data, oF											Stack	
	Gas Meter Cubic Feet	Sample Rate, cfm	Orifice dH	Meter oF	Meter Vac. In. Hg.	Dilution Tunnel Temp.	Dilution Tunnel dP	Pro. Rate (10%)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Filter	Impinger exit	Ambient	Draft In. H2O	Catalyst Temp.
0	0.000		0.00	74	0	107	0.041		4.9		503	577	316	559	529		496.8	343	75	67	72	-0.044	
10	5.217	0.52	0.90	74	1	116	0.041	101	3.4	-1.5	497	585	304	513	483		476.4	427	79	49	73	-0.060	
20	10.482	0.53	0.90	76	1	114	0.041	101	2.0	-1.4	547	535	307	555	529		494.6	432	82	50	71	-0.058	
30	15.739	0.53	0.90	78	1	112	0.041	101	0.9	-1.1	577	512	319	589	561		511.6	421	83	51	74	-0.058	
40	21.018	0.53	0.90	79	1	110	0.041	101	0.5	-0.4	583	509	330	609	581		522.4	377	84	52	73	-0.050	
50	26.299	0.53	0.90	81	1	105	0.041	100	0.3	-0.2	526	533	321	591	550		504.2	332	83	52	71	-0.045	
60	31.599	0.53	0.90	82	1	102	0.041	100	0.0	-0.3	478	546	305	568	522		483.8	311	82	54	71	-0.043	
Avg/Total	31.599	0.53	0.77	77.71		109.36	0.041	100.69									13		81.14	53.57		-0.051	#DIV/0!

OMNI-Test Laboratories, Inc.

Final Laboratory Report - Method 5G
Dilution Tunnel Particulate Calculations

Client Name: Morso
Model: 6100 Series
Project No.: 192-S-15-3
Tracking No.: 1120

Equipment Numbers:

Run #: 4
Date: 11/02/07

Sample Component	Reagent	Filter # or Volume, ml	Weights			
			Final, mg	Tare, mg	Blank, mg/ml	Particulate, mg
A. Front filter catch	Filter	N461	578.4	569.0		9.4
B. Rear filter catch	Filter	N460	591.5	592.0		-0.5
C. Rinse of probe and filter assembly	Acetone	100	102836.6	102830.9	0.0173	4.0

Total Particulate, mg :	12.9

Component	Equations:
A. Front filter catch	Final (mg) - Tare (mg) = Particulate, mg
B. Rear filter catch	Final (mg) - Tare (mg) = Particulate, mg
C. Rinse of probe and filter assembly	(Final, mg - Tare, mg) - (Blank, mg/ml x Volume, ml) = Particulate, mg

Analyst: BC Date: 11-7-07

Wood Heater Test Data - EPA Method 5G Preburn

Run: 4

Manufacturer: Morso
Model: 6100 Series
Tracking No.: 1120
Project No.: 192-S-15-3
Preburn Date: 39388

Recording Interval: 10 min.

Coal Bed Range: 1.0 - 1.2
Actual Coal Bed: 1.2

Signature/Date: K. J. Morgan 11-26-07

OMNI Equipment Numbers:

Elapsed Time	Fuel Weight, lb		Wood Heater Temperature Data, oF									Stack	
	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Ambient	Draft In. H2O	Catalyst Temp.
0	7.3		353	551	260	445	434	0	408.6	401	69	-0.053	NA
10	5.9	-1.4	405	519	256	464	466	0	422.0	399	69	-0.055	NA
20	4.6	-1.3	474	461	282	520	513	0	450.0	418	71	-0.058	NA
30	3.4	-1.2	532	431	304	558	547	0	474.4	421	70	-0.058	NA
40	2.4	-1	567	429	319	580	565	0	492.0	419	66	-0.055	NA
50	1.7	-0.7	575	466	326	591	568	0	505.2	393	71	-0.053	NA
60	1.4	-0.3	551	532	322	584	559	0	509.6	349	71	-0.048	NA
70	1.2	-0.2	509	571	313	564	535	0	498.4	322	72	-0.043	NA
Avg/Total													

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FUEL DATA

Client: Morso
Model: 6100 Series
Project #: 192-S-15-3 Tracking #: 1120
Date: 11-02-07 Test Crew: K. Morgan Run #: 4
OMNI Equipment ID #: _____
FUEL LOAD PREPARED BY: K. Morgan
FUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER, DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER – – DRY BASIS)

CALIBRATION: Cal Value (1) = 12% Actual Reading 12.0
Cal Value (2) = 22% Actual Reading 22.0

Piece	Length	Readings			Type
1	8 ft	23.2	21.6	19.0	2x4
2	____ ft				
3	____ ft				

Length of cut pieces: 4@8" 4@11" inches Pre-Burn Fuel Average Moisture: 21.27 %

Time (clock): 13:25 Room Temperature (F): 67 Initials: IK

TEST FUEL

FUEL TYPE AND AMOUNT: 2 × 4 3 4 × 4 0
CALCULATED LOAD WEIGHT: 5.208 lb. ACTUAL LOAD WEIGHT: 4.9 (2 × 4)
0 (4 × 4)
FUEL PIECE LENGTH: 11.0" 4.9 Total

MOISTURE CONTENT (METER – – DRY BASIS)

PIECE	READINGS			TYPE
1	21.5	20.5	22.0	2x4
2	25.0	20.6	19.7	2x4
3	25.3	20.8	22.6	2x4
4				
5				
6				
7				
8				
9				
10				

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 22.0 %

Time (clock): 13:55 Room Temperature (F): 68 Initials: IK

Technician signature: K. Morgan Date: 11-02-07

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PRELIMINARY: 1.82 4.68

Run Notes

Client: Morso
Model: 6100 Series
Project #: 192-S-15-3
Tracking #: 1120
Run #: 4 Date: 11-02-07
Test Crew: K. Morgan
OMNI Equipment ID #(s):

PREBURN

DESCRIBE OR SKETCH AIR OR THERMOMSTAT SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCABLE)

PRIMARY:

Full open

SECONDARY: FIXED

TERTIARY: NONE

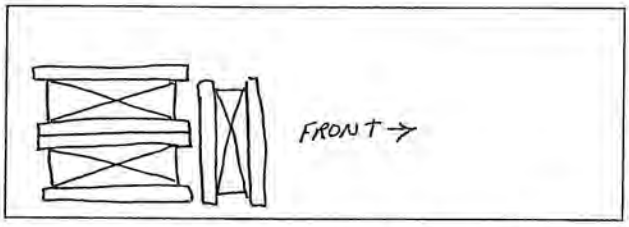
FAN: NONE

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
0	test setting					
70					X	Levelled

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)



START UP PROCEDURES

BYPASS: N/A
FUEL LOADING: Loaded by 45 sec.
DOOR: AJAR until 4.75 min.
PRIMARY AIR: Full open Duration of test.
OTHER: NONE.

DESCRIBE OR SKETCH TEST SETTINGS BELOW:
(SETTINGS MUST BE ACCURATE AND REPRODUCIBLE)
PRIMARY:

SAME AS ABOVE

SECONDARY: FIXED

TERTIARY: NONE

FAN: NONE

Technician signature: K. Morgan Date: 11-02-07

Supplemental Data EPA 5G/5H

Client: Morso

Model: 6100 Series

Project #: 192-S-15-3 Tracking #: 1120

Date: 11-02-07 Run #: 4 Booth: 1

Test Crew: K. Morgan Start Time: 14:43 Stop Time: 15:43

OMNI Equipment #(s):

Gas Analyzer Train Leak Check:

Stack: Initial: N/A Final: N/A

Dilution Tunnel (Method 5G Only): Initial: N/A Final: N/A

Calibrations: Span Gas CO_2: N/A ~~O_2:~~ ~~CO:~~ ~~CO_2(DT):~~

Time	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span
O_2			N/A				
CO_2							
CO							
CO_2 (DT)							

Stack Diameter (inches): 6.0

Air Velocity (ft/min): Initial: < 50 Final: < 50

Scale Audit (lbs): Pretest: 10.0 Post Test: 10.0

Induced Draft: Ø %Smoke Capture: 100

Pitot Tube Leak Test: Pre: Ø @ 3.2" W.C. Post: Ø @ 3.1" W.C

Flue Pipe Cleaned Prior to First Test in Series: Date: 10-31-07 Initials: K

	Initial	Middle	Ending
Pb (in/Hg)	30.30	30.29	30.28
Room Temp (°F)	72	74	71

Technician signature: K. Morgan Date: 11-02-07

Section 5

Sampling Procedures and Test Results

INTRODUCTION

Morsø Jernstøberi A/S retained *OMNI* to perform U.S. Environmental Protection Agency (EPA) certification testing on the 6100 Series wood stove. The 6100 Series wood stove is a non-catalytic, freestanding, radiant-type room heater. The firebox is constructed of mild steel. The usable firebox volume was measured to be 0.7 cubic feet. The stove is vented through a 6-inch diameter flue collar located at the top of the unit.

The testing was performed at *OMNI*'s testing facility in Beaverton, Oregon. The altitude of the laboratory is 204 feet above sea level. The unit was received in good condition and logged in on October 9, 2007, then assigned and labeled with *OMNI* ID #1120. *OMNI* representatives Bruce Davis and Ken Morgan conducted the certification testing and completed all testing by November 2, 2007. The EPA was notified of the testing dates in a letter dated September 28, 2007. A testing contract, including provisions for Random Compliance Audit (RCA) testing, has been signed by Karsten Aagaard of Morsø Jernstøberi A/S and is on file at *OMNI*'s testing facility.

The 6100 Series wood stove was tested in accordance with the U.S. EPA 40 CFR Part 60, Subpart AAA – Standard of Performance for Residential Wood Heaters (Appendix A, Methods 28 and 5G). Particulate emissions were measured using a Method 5G sampling train consisting of two filters (front and back). The weighted average emissions of the four test runs included in the results indicate a particulate emission level of 4.1 grams per hour. Test runs were conducted in each of three burn rate categories (0.80-1.25 kg/hr, 1.25-1.90 kg/hr, and maximum). Emissions for each of their individual test runs did not exceed the cap. The 6100 Series results are within the emission limit of 7.5 grams per hour for non-catalytic affected facilities manufactured on or after July 1, 1990, or sold at retail on or after July 1, 1992.

The wood heater was sealed after completion of testing in compliance with the EPA regulation as follows:

- "DO NOT TAMPER" labels were placed on the door and on all other openings.
- Plastic material sealed with "DO NOT TAMPER" labels and tape was wrapped around the unit.
- The unit was sealed in a wood box constructed for the unit and secured with steel banding.
- "DO NOT TAMPER" labels were placed on all outer surfaces of the box.

This report is organized in accordance with the EPA-recommended outline and is summarized in the Table of Contents immediately preceding this report. The results in this report are limited to the item submitted.

Table 1.1 – Particulate Emissions

Run	Burn Rate (kg/hr dry)	Method 5G Emissions (g/hr)
1	1.03	4.09
2	0.92	1.68
3	1.39	5.35
4	1.82	5.34
Weighted particulate emission average of four test runs: 4.1 grams per hour.		

Table 1.2 – Test Facility Conditions

Run	Room Temperature (°F)		Barometric Pressure (Hg)		Air Velocity (ft/min)	
	Before	After	Before	After	Before	After
1	65	69	30.28	30.27	<50	<50
2	70	68	30.27	30.27	<50	<50
3	67	69	30.33	30.33	<50	<50
4	72	71	30.30	30.28	<50	<50

Table 1.3.1 – Fuel Measurement and Crib Description Summary – PRETEST

Run	Pretest Fuel Weight (Starting weight in lbs)	Pretest Moisture (Dry basis - %)	Coal Bed Weight (lbs)
1	4.8	23.3	1.0
2	4.9	21.8	1.2
3	8.0	23.0	1.0
4	7.3	21.3	1.2

Table 1.3.2 – Fuel Measurement and Crib Description Summary – TEST

Run	Test Fuel Wet Basis (lbs)	Firebox Volume (ft^3)	Fuel Loading Density Wet Basis (lbs/ft^3)	Fuel Moisture Content Dry (%)	Piece Length (in)	2x4s Used	4x4s Used
1	5.0	0.7	7.14	19.9	11	3	0
2	4.9	0.7	7.00	20.6	11	3	0
3	5.0	0.7	7.14	22.5	11	3	0
4	4.9	0.7	7.00	22.0	11	3	0

Table 1.4 – Dilution Tunnel Gas Measurements and Sampling Data Summary

Run	Length of Test (min)	Average Dilution Tunnel Gas Measurements		
		Velocity (ft/sec)	Flow Rate (dscf/min)	Temperature (°F)
1	110	13.18	142.6	96.8
2	120	12.98	140.5	96.2
3	80	13.47	144.7	101.5
4	60	13.83	146.3	109.4

Table 1.5 - Heater Operation Data (Average Temperature Data)

Run	Beginning Surface Temperature Average[a]	Ending Surface Temperature Average[a]	Surface Delta T[b]
1	439.2	364.2	75
2	402.8	362.4	40
3	450.4	441.8	9
4	496.8	483.8	13
a. All temperatures are in degrees F.			
b. Represents the difference between beginning and ending average surface temperatures.			

Table 1.6 – Pretest Configuration

Run	Combustion Air (in)	Fuel Added	Fuel Removed	Time (min)
1	Open 0.375"	4.8 lbs at start; no addition; coal bed 1.0 lbs	0.0	60
2	Open 0.250"	4.9 lbs at start; no addition; coal bed 1.2 lbs	0.0	70
3	Fully Open	8.0 lbs at start; no addition; coal bed 1.0 lbs	0.0	110
4	Fully Open	7.3 lbs at start; no addition; coal bed 1.2 lbs	0.0	70

Table 1.7 – Run Data

Run	Average Dry Burn Rate (kg/hr)	Initial (Induced) Draft (H_2O)	Primary Air Setting (in)	Run Time (min)	Average Draft (H_2O)
1	1.03	0	Open 0.375"	110	-0.038
2	0.92	0	Open 0.250"	120	-0.036
3	1.39	0	Fully Open	80	-0.048
4	1.82	0	Fully Open	60	-0.051

Table 1.8 – Test Configurations

Run	Five-Minute Startup	Combustion Air
1	Bypass: N/A. Fuel Loading: Loaded by 60 seconds. Door: Closed at 3.0 minutes. Primary Air: Fully open for 5.0 minutes. Other: None. Secondary: Fixed. Tertiary: None. Fan: None.	Open 0.375"
2	Bypass: N/A. Fuel Loading: Loaded by 60 seconds. Door: Closed at 3.0 minutes. Primary Air: Fully open for 5.0 minutes. Other: None. Secondary: Fixed. Tertiary: None. Fan: None.	Open 0.250"
3	Bypass: N/A. Fuel Loading: Loaded by 40 seconds. Door: Closed at 50 seconds. Primary Air: Fully open for duration of test. Other: None. Secondary: Fixed. Tertiary: None. Fan: None.	Fully Open
4	Bypass: N/A. Fuel Loading: Loaded by 45 seconds. Door: Closed at 4.75 minutes. Primary Air: Fully open for duration of test. Other: None. Secondary: Fixed. Tertiary: None. Fan: None.	Fully Open

TEST RESULTS AND DISCUSSION

A total of four test runs were performed on the 6100 Series wood stove. Four test runs were conducted in the following categories and included in the weighted average emission level results: two in the 0.80 to 1.25 kg/hr dry category; one in the 1.25 to 1.90 kg/hr dry category; and one at maximum.

The weighted particulate emission level was measured to be 4.1 g/hr.

The proportionality results for all four test runs were acceptable. Quality check results for each test run are presented in Section 2 of this report.