Certification Test Report

Morsø Jernstøberi A/S

Freestanding Wood Stove
Model: 8140

Report Number 192-S-07-3

OMNI-Test Laboratories, Inc.
Product Testing & Certification

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Model: 8140
Morsø Jernstøberi A/S
Furvej 6 DK-7900
Nykobing Mors
DENMARK

Certification Test Report

Morsø Jernstøberi A/S

Freestanding Wood Stove
Model: 8140

Prepared for:	Morsø Jernstøberi A/S Furvej 6 DK-7900 DENMARK
Prepared by:	OMNI-Test Laboratories, Inc. 5465 SW Western Avenue, Suite G Beaverton, Oregon 97005 (503) 643-3788
Test Period:	October 6, 2005 through October 9, 2005
Report Date:	October 2005
OMNI-Test Project Number:	192-S-07-3

Model: 8140
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AUTHORIZED SIGNATORIES

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

Richard Sparwasser, Vice President
OMNI-Test Laboratories, Inc.

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

Bruce Davis, Technician
OMNI-Test Laboratories, Inc.

Model: 8140
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Morsø Jernstøberi A/S
Model: 8140
Test Dates: October 6, 2005 to October 9, 2005

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Section 1

Sampling Procedures and Test Results

Model: 8140
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INTRODUCTION

Morsø Jernstøberi A/S retained OMNI-Test Laboratories, Inc. (O–TL) to perform U.S. Environmental Protection Agency (EPA) certification testing on the model 8140 wood stove. The 8140 wood stove is a non-catalytic, freestanding, convection-type room heater. The firebox is constructed of cast iron with several components made of mild and stainless steel. The usable firebox volume was measured to be 1.05 cubic feet. The stove is vented through a 6" diameter flue collar located at the top of the unit.

The testing was performed at the O–TL laboratory in Beaverton, Oregon. The altitude of the laboratory is 204 feet above sea level. The unit was received in good condition and logged in at the O–TL test facility on September 20, 2005; it was assigned and labeled with O–TL ID #786. O–TL representative Bruce Davis conducted the certification testing and completed all testing by October 7, 2005. The EPA was notified of the testing dates in a letter dated September 29, 2005. A testing contract, including provisions for Random Compliance Audit (RCA) testing, has been signed by Karsten Aargard of Morsø Jernstøberi A/S and is on file at O–TL.

The 8140 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 indicate a particulate emission level of 4.5 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 8140 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 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; and
- "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.

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Table 1.1 – Particulate Emissions

Run	Burn Rate (kg/hr dry)	Method 5G Emissions (g/hr)
1	0.91	3.68
2	2.10	9.38
3	1.42	4.09
4	1.13	2.43
Weighted particulate emission average of four test runs: 4.5 grams per hour.		

Table 1.2 – Test Facility Conditions

Run	Room Temperature (°F)		Barometric Pressure (in Hg)		Air Velocity (ft/min)	
	Before	After	Before	After	Before	After
1	73	75	29.84	29.83	<50	<50
2	74	72	29.82	29.82	<50	<50
3	67	69	29.84	29.85	<50	<50
4	68	69	29.82	29.83	<50	<50

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Table 1.3.1 – Fuel Measurement and Crib Description Summary – PRETEST

Run	Pretest Fuel Weight (Starting weight)	Pretest Moisture (Dry basis - %)	Coal Bed Weight (lb)
1	4.6	21.1	1.7
2	11.9	20.6	1.5
3	10.9	23.1	1.7
4	5.8	20.9	1.7

Table 1.3.2 – Fuel Measurement and Crib Description Summary – TEST

Run	Test Fuel Wet Basis (lb)	Firebox Volume (ft^3)	Fuel Loading Density Wet Basis (lb/ft^3)	Fuel Moisture Content Dry (%)	Piece Length (in)	2x4s Used	4x4s Used
1	6.8	1.05	6.48	19.9	12.5	4	0
2	7.5	1.05	7.14	21.3	12.5	4	0
3	6.9	1.05	6.57	19.8	12.5	4	0
4	7.0	1.05	6.67	20.2	12.5	4	0

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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)	Temp (°F)
1	170	12.79	135.8	98.8
2	80	13.33	135.9	121.5
3	110	13.51	142.3	103.5
4	140	13.52	144.1	96.7

Table 1.5 - Heater Operation Data (Average Temperature Data)

Run	Beginning Surface Temp Average[a]	Ending Surface Temp Average[a]	Surface Delta T[b]
1	345.6	292.0	54
2	526.0	421.4	105
3	446.6	346.8	100
4	382.2	330.0	52
a. All temperatures are in degrees F.			
b. Surface Delta T represents the difference between beginning and ending average surface temperature.			

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Table 1.6 – Pretest Configuration

Run	Combustion Air (in)	Fuel Added	Fuel Removed	Time (min)
1	13mm *	4.6 lbs. at start; no addition; coal bed 1.7 lbs.	0	71
2	29mm **	11.9 lbs. at start; no addition; coal bed 1.5 lbs.	0	66
3	23mm *	10.9 lbs. at start; no addition; coal bed 1.7 lbs.	0	76
4	17mm *	5.8 lbs. at start; no addition; coal bed 1.7 lbs.	0.3	68

* Measured from the "fully closed" setting
** 29mm = fully open since additional lever movement does not change air flow

Table 1.7 – Run Data

Run	Average Dry Burn Rate (kg/hr)	Initial (Induced) Draft (in H_2O)	Primary Air Setting (in)	Run Time (min)	Average Draft (in H_2O)
1	0.91	0	13mm *	170	-0.040
2	2.10	0	Fully Open**	80	-0.064
3	1.42	0	23mm *	110	-0.053
4	1.13	0	17mm *	140	-0.046

* Measured from the "fully closed" setting
** 29mm = fully open since additional lever movement does not change air flow

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Table 1.8 – Test Configuration

Run	Five-Minute Startup	Combustion Air
1	Bypass: N/A. Fuel Loading: Loaded by 30 seconds. Door: Cracked open until 4:10; then closed. Primary Air: Fully open until 4:15; adjusted to test setting by 5:00. Other: N/A. Secondary: Fixed. Tertiary: N/A. Fan: N/A.	13mm *
2	Bypass: N/A. Fuel Loading: Loaded by 25 seconds. Door: Cracked open until 2:10; then closed. Primary Air: Fully open until 5:00. Other: N/A. Secondary: Fixed. Tertiary: N/A. Fan: N/A.	Fully Open**
3	Bypass: N/A. Fuel Loading: Loaded by 20 seconds. Door: Cracked open until 2:15; then closed. Primary Air: Fully open until 5:00. Other: N/A. Secondary: Fixed. Tertiary: N/A. Fan: N/A.	23mm *
4	Bypass: N/A. Fuel Loading: Loaded by 25 seconds. Door: Cracked open until 4:00; then closed. Primary Air: Fully open until 4:00; adjusted to test setting by 5:00. Other: N/A. Secondary: Fixed. Tertiary: N/A. Fan: N/A.	17mm *

* Measured from the "fully closed" setting
** 29mm = fully open since additional lever movement does not change air flow

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TEST RESULTS AND DISCUSSION

A total of four test runs were conducted in the following categories: two in the 0.80 to 1.25 kg/hr dry category; one in the 1.26 to 1.90 kg/hr dry category; and one at maximum.

The weighted particulate emission level was measured to be 4.5 grams per hour.

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.

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APPLIANCE DESCRIPTION

Appliance Manufacturer: Morsø Jernstøberi A/S

Wood Stove Model: 8140

Type: Freestanding, convection-type room heater

WOOD HEATER DESCRIPTION:

Materials of Construction: The unit is constructed of cast iron with several components made of mild and stainless steel.

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 vertically to two openings supplying one 1" square tube.

Combustion Control Mechanisms: The combustion air inlet is controlled by a handle located below 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: N/A.

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

WOOD HEATER OPERATING INSTRUCTIONS

Specific written instructions: See Section 4 of this report. All markings and instruction materials were reviewed for content prior to printing.

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Section 2

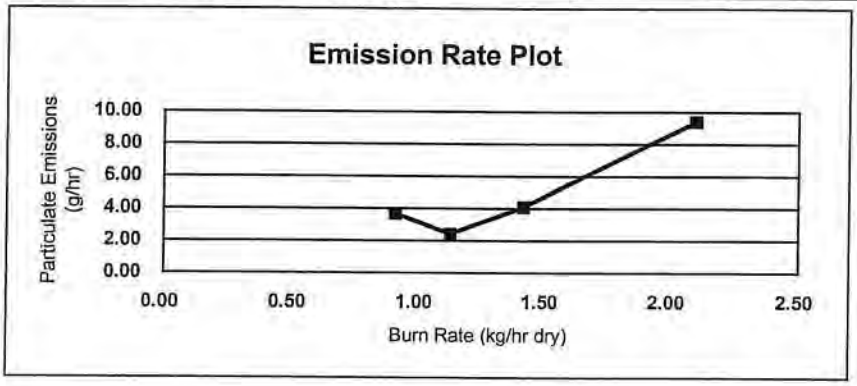
Test Data by Run

EPA Weighted Average Emissions
EPA Method 28

Client: Morso
Stove Model: 8100
Test Dates: Oct 6, 2005 through Oct 9 2005
Project Number: 192-S-07-3
Tracking Number: 786
Signature/Date: 11-1-05

Status: Final
Stove Type: Non-Catalytic Stove

Weighted Average (g/hr)
4.5



Run #	1	
Burn Rate (dry kg/hr)	0.91	
Catagory	2	
Overall Efficiency (%)	63%	
Emissions (g/hr)	3.68	
Cap (g/hr)	15	
Weighting Factor	0.478	29.52%
Heat Output (BTU/hr)	10996	

Run #	4	
Burn Rate (dry kg/hr)	1.13	
Catagory	2	
Overall Efficiency (%)	63%	
Emissions (g/hr)	2.43	
Cap (g/hr)	15	
Weighting Factor	0.400	24.71%
Heat Output (BTU/hr)	13654	

Run #	3	
Burn Rate (dry kg/hr)	1.42	
Catagory	3	
Overall Efficiency (%)	63%	
Emissions (g/hr)	4.09	
Cap (g/hr)	15	
Weighting Factor	0.447	27.60%
Heat Output (BTU/hr)	17159	

Run #	2	
Burn Rate (dry kg/hr)	2.10	
Catagory	4	
Overall Efficiency (%)	63%	
Emissions (g/hr)	9.38	
Cap (g/hr)	18	
Weighting Factor	0.294	18.17%
Heat Output (BTU/hr)	25375	

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Run 1

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Run: 1

Manufacturer:	Morso	
Model:	8100	
Tracking No.:	786	
Project No.:	192-S-07-3	
Test Date:	06-Oct-05	
Beginning Clock Time:	13:44	
Recording Interval:	10	min.
Total Sampling Time:	170	min.

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
Initial dP	0.030	0.042	0.038	0.024	0.024	0.040	0.046	0.034	"H2O
Initial Temp.	100	100	100	100	99	99	99	99	oF

OMNI Equipment Numbers:

PM Control Module:	21	
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:	-0.650	"H2O
Pitot Tube Cp:	0.99	
Meter Box Y Factor:	0.988	

Barometric Pressure:	Begin	Middle	End	Average
	29.84	29.83	29.83	29.83 "Hg

Signature/Date: BWL 11-1-05

Tunnel Velocity:	12.79	ft/sec.
Intial Tunnel Flow:	134.8	scfm
Average Tunnel Flow:	135.8	scfm
Tunnel Area:	0.196	ft2
Post-Test Leak Check:	.004@5	cfm@"Hg
Fuel Moisture (dry basis)	19.88	%
Total Particulate:	23.8	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	Average Surface	Stack	Filter	Impinger exit	Ambient	Draft In. H2O
0	437.000		0.75	73	0	100	0.035		6.8		396	119	390	413	410	345.6	249	77	70	73	-0.033
10	442.170	0.52	0.75	85	1	107	0.035	103	5.8	-1	403	119	412	395	392	344.2	311	80	46	72	-0.046
20	447.360	0.52	0.75	94	1	102	0.035	101	4.9	-0.9	415	116	440	389	388	349.6	320	81	45	74	-0.048
30	452.570	0.52	0.75	99	1	105	0.035	101	3.8	-1.1	464	115	529	402	424	386.8	366	81	45	74	-0.054
40	457.820	0.53	0.75	103	1	106	0.035	101	2.7	-1.1	526	113	607	439	478	432.6	388	81	46	76	-0.055
50	463.070	0.53	0.75	104	1	104	0.035	100	1.7	-1	561	111	625	467	512	455.2	369	81	46	75	-0.050
60	468.250	0.52	0.75	105	1	101	0.035	99	1.4	-0.3	530	109	556	474	506	435.0	322	81	46	75	-0.047
70	473.520	0.53	0.75	106	1	99	0.035	100	1.2	-0.2	485	107	492	462	478	404.8	293	81	46	74	-0.042
80	478.550	0.50	0.75	107	1	98	0.035	95	1.1	-0.1	449	105	452	447	454	381.4	276	80	46	73	-0.040
90	483.900	0.53	0.75	107	1	97	0.035	101	1.0	-0.1	420	105	423	434	437	363.8	264	80	46	73	-0.037
100	489.300	0.54	0.75	108	1	96	0.035	102	0.8	-0.2	400	105	403	422	424	350.8	255	80	46	75	-0.036
110	494.750	0.54	0.75	109	1	96	0.035	103	0.7	-0.1	380	105	384	410	412	338.2	247	80	45	75	-0.035
120	500.090	0.53	0.75	109	1	96	0.035	101	0.6	-0.1	369	106	373	401	404	330.6	243	80	45	74	-0.034
130	505.430	0.53	0.75	109	1	95	0.035	100	0.4	-0.2	359	106	364	394	398	324.2	239	80	46	75	-0.034
140	510.790	0.54	0.75	109	1	95	0.035	101	0.3	-0.1	347	106	351	384	388	315.2	232	80	47	74	-0.033
150	516.140	0.53	0.75	109	1	94	0.035	101	0.2	-0.1	337	105	340	373	377	306.4	227	80	48	73	-0.032
160	521.500	0.54	0.75	108	1	94	0.035	101	0.1	-0.1	327	105	330	362	366	298.0	223	79	47	73	-0.031
170	526.805	0.53	0.75	109	1	94	0.035	100	0.0	-0.1	320	105	323	354	358	292.0	219	79	48	75	-0.031
Avg/Total	89.805	0.53	0.75	102.94		98.81	0.035	100.45								54		80.06	47.44		-0.040

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Manufacturer: Morso
Model: 8100
Project No.: 786
Tracking No.: 192-S-07-3
Run: 1
Test Date: 10/06/05

Burn Rate	0.91 kg/hr dry
Particulate Concentration (dry-standard) Particulate Emission Rate Adjusted Emissions	0.00029 grams/dscf 2.33 grams/hour 3.68 grams/hour
Average Tunnel Temperature	99 degrees Fahrenheit
Average Delta p	0.035 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	89.80 cubic feet 103 degrees Fahrenheit 12.79 feet/second 8147.48 dscf/hour 83.13 dscf
Total Particulates - mn Average Delta H Total Time of Test	23.8 mg 0.75 inches H20 170 minutes

Run 1
25 + 2-34

Final Laboratory Report - Method 5G
Dilution Tunnel Particulate Calculations

Client Name: Morso
Model: 8100
Project No.: 192-S-07-3
Tracking No.: 786
Equipment Numbers:
Run #: 1
Date: 10/06/05

Sample Component	Reagent	Filter # or Volume, ml	Weights			
			Final, mg	Tare, mg	Blank, mg/ml	Particulate, mg
A. Front filter catch	Filter	M832	565.2	547.9		17.3
B. Rear filter catch	Filter	M831	548.8	547.6		1.2
C. Rinse of probe and filter assembly	Acetone	95	109919.8	109914.4	0.0013	5.3

Total Particulate, mg :	23.8

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: Date: 10-12-05

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

STOVE TEMPERATURE TEST DATA - METHOD 5G

Client/Model: Morso Project #: 192-S-07-3 Tracking #: 786

Date: 10-6-05 Test Crew: B Davis Run #: 1

OMNI Equipment ID #:

Preburn [X]
Test [ ]

Coal Bed:
Data: 0 = Ø Range: 1.4 - 1.7

Actual:
Coal Bed: 1.7

Time	Fuel Weight	Delta Weight	Stack Draft	TEMPERATURES (oF) Ambient	Top	Bottom	Back	Left	Right	Flue	Catalyst
0	4.6	—	-.067	72	684	114	802	525	584	513	NA
10	3.5	1.1	-.052	70	618	121	669	548	589	365	
20	2.9	0.6	-.049	69	592	119	637	534	569	340	
30	2.3	0.6	-.046	68	556	118	577	513	542	312	
40	2.1	0.2	-.041	73	507	120	511	483	499	282	
50	1.9	0.2	-.037	73	459	119	455	451	457	258	
60	1.9	0.0	-.035	72	426	119	420	430	431	244	
70	1.7	0.2	-.032	74	401	119	397	415	413	234	
80											
90											
00											
10											
20											
30											
40											
50											
60											
70											
80											
90											
AVG											

Technician signature: B.D. Date: 10-12-05

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OMNI-Test Laboratories, Inc.
Beaverton, OR

FUEL DATA

Client: Morso
Model: 8100
Project #: 192-S-07-3 Tracking #: 786
Date: 10-6-05 Test Crew: B. Davis Run #: 1
OMNI Equipment ID #:
FUEL LOAD PREPARED BY: B. Davis
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
Cal Value (2) = 22% Actual Reading 22

Piece	Length	Readings			Type
1	8 ft	19.4	20.4	19.8	2x4
2	8 ft	23.0	21.8	22.4	2x4
3	ft				

Length of cut pieces: 4 @ 10 / 6 @ 12.5 inches Pre-Burn Fuel Average Moisture: 21.13

Time (clock): 0915 Room Temperature (F): 68 Initials: BD

TEST FUEL

FUEL TYPE AND AMOUNT: 2 × 4 4 4 × 4 0
CALCULATED LOAD WEIGHT: 7.35 ACTUAL LOAD WEIGHT: 6.8 (2 × 4)
— (4 × 4)
6.8 Total

FUEL PIECE LENGTH: 12.5

MOISTURE CONTENT (METER – – DRY BASIS)

PIECE	READINGS			TYPE
1	20.6	19.7	18.9	2x4
2	19.0	20.2	19.1	2x4
3	20.0	20.2	20.2	2x4
4	20.2	20.0	20.5	2x4
5				
6				
7				
8				
9				
10				

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 19.88

Time (clock): 1100 Room Temperature (F): 70 Initials: BD

Technician signature: BD Date: 10-12-05

OMNI-Test Laboratories, Inc.
Beaverton, OR

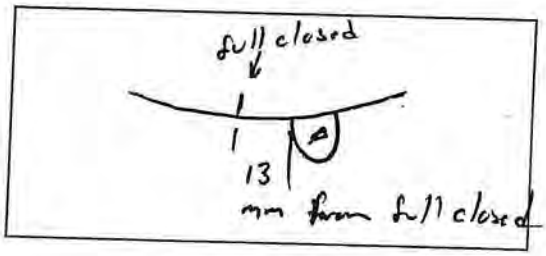
Run Notes

Client/Model: Morso
Model: 8100
Project #: 192-S-07-3
Tracking Number: 786
Run #: 1 Date: 10-6-05
Test Crew: BB Davis
OMNI Equipment ID Numbers:

PREBURN

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

PRIMARY:



SECONDARY: fixed

TERTIARY: NA

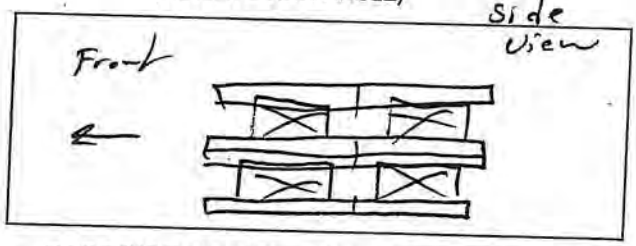
FAN: NA

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					
71					X	→

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)



START UP PROCEDURES

BYPASS: NA
FUEL LOADING By 30 sec
DOOR: Cracked open until 4:10 Then closed
PRIMARY AIR: fully open until 4:15 Then slowly set to test setting @ 5:00
OTHER: NA

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

Same as Above

SECONDARY: ~~NA~~ fixed BC

TERTIARY: NA

FAN: NA

Technician signature: BB Davis Date: 10-12-05

OMNI-Test Laboratories, Inc.
Beaverton, OR

Supplemental Data EPA 5G/5H

Client: Morso

Model: 8100

Project No.: 192-S-07-3 Tracking No.: 786

Date: 10-6-05 Run No.: 1 Booth: 1

Test Crew: BO AVS Start Time: 13:44 Stop Time: 16:34

OMNI Equipment #'s:

Gas Analyzer Train Leak Check:

Stack:

Initial: NA

Final:

Dilution Tunnel (Method 5G Only):

Initial:

Final:

Calibrations: Span Gas CO_2: 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
	NA						
O_2							
CO_2							
CO							
CO_2 (DT)							

Stack Diameter (inches): 6

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

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

Induced Draft: 0.0 %Smoke Capture: 100 %

Pitot Tube Leak Test: Pre: 0.0 @ 3.0 Post: 0.0 @ 3.1

Flue Pipe Cleaned Prior to First Test in Series: Date: 10-5-05 Initials: BO

	Initial	Middle	Ending
Pb (in. Hg)	29.84	29.83	29.83
Room Temp (°F)	73	73	75

Technician signature: Date: 10-12-05

Model: 8140
Morsø Jernstøberi A/S
Furvej 6 DK-7900
Nykobing Mors
DENMARK

Run 2

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Run: 2

Manufacturer:	Morso
Model:	8100
Tracking No.:	786
Project No.:	192-S-07-3
Test Date:	06-Oct-05
Beginning Clock Time:	18:01
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	0.038	0.038	0.044	0.036	0.028	0.042	0.036	0.028	"H2O
Initial Temp.	132	132	132	132	131	131	131	131	oF

OMNI Equipment Numbers: _____

PM Control Module:	21				
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:	0.988				
Barometric Pressure:	Begin	Middle	End	Average	
	29.82	29.82	29.82	29.82	"Hg

Signature/Date: [signature] 11-1-05

Tunnel Velocity:	13.33	ft/sec.
Intial Tunnel Flow:	134.4	scfm
Average Tunnel Flow:	135.9	scfm
Tunnel Area:	0.196	ft2
Post-Test Leak Check:	.004@4	cfm@"Hg
Fuel Moisture (dry basis)	21.27	%
Total Particulate:	34.6	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	Average Surface	Stack	Filter	Impinger exit	Ambient	Draft In. H2O
0	527.100		0.75	76	0	132	0.036		7.5		633	134	663	594	606	526.0	458	76	69	74	-0.058
10	532.280	0.52	0.75	85	1	133	0.036	103	5.5	-2	653	141	763	552	570	535.8	598	79	43	72	-0.075
20	537.450	0.52	0.75	93	1	133	0.036	101	3.1	-2.4	719	142	856	548	613	575.6	607	81	41	72	-0.075
30	542.680	0.52	0.75	97	1	132	0.036	102	1.3	-1.8	755	136	894	573	660	603.6	609	82	41	74	-0.074
40	547.850	0.52	0.75	100	1	122	0.036	99	0.8	-0.5	700	132	780	596	657	573.0	515	82	42	75	-0.065
50	553.120	0.53	0.75	102	1	115	0.036	100	0.6	-0.2	619	128	661	584	607	519.8	458	81	42	74	-0.060
60	558.500	0.54	0.75	103	1	112	0.036	102	0.4	-0.2	555	127	591	556	562	478.2	425	81	43	74	-0.057
70	563.670	0.52	0.75	104	1	109	0.036	97	0.2	-0.2	506	125	536	529	526	444.4	397	80	44	75	-0.055
80	568.878	0.52	0.75	105	1	106	0.036	98	0.0	-0.2	474	125	500	508	500	421.4	380	80	44	72	-0.053
Avg/Total	41.778	0.52	0.75	96.11		121.50	0.036	100.21								105		80.22	45.44		-0.064

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Manufacturer: Morso
Model: 8100
Project No.: 786
Tracking No.: 192-S-07-3
Run: 2
Test Date: 10/06/05

Burn Rate	2.10 kg/hr dry
Particulate Concentration (dry-standard) Particulate Emission Rate Adjusted Emissions	0.00088 grams/dscf 7.21 grams/hour 9.38 grams/hour
Average Tunnel Temperature	122 degrees Fahrenheit
Average Delta p	0.036 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	41.78 cubic feet 96 degrees Fahrenheit 13.33 feet/second 8155.14 dscf/hour 39.13 dscf
Total Particulates - mn Average Delta H Total Time of Test	34.6 mg 0.75 inches H20 80 minutes

Final Laboratory Report - Method 5G
Dilution Tunnel Particulate Calculations

Client Name: Morso
Model: 8100
Project No.: 192-S-07-3
Tracking No.: 786
Equipment Numbers:
Run #: 2
Date: 10/06/05

Sample Component	Reagent	Filter # or Volume, ml	Weights			
			Final, mg	Tare, mg	Blank, mg/ml	Particulate, mg
A. Front filter catch	Filter	M834	580.2	550.7		29.5
B. Rear filter catch	Filter	M833	551.6	552.6		-1.0
C. Rinse of probe and filter assembly	Acetone	85	102838.2	102832.0	0.0013	6.1

Total Particulate, mg :	34.6

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: Date: 10-12-05

STOVE TEMPERATURE TEST DATA - METHOD 5G

Client/Model: Morso 8100 Project #: 192-S-07-3 Tracking #: 786

Date: 10-6-05 Test Crew: BQ Davis Run #: 2

OMNI Equipment ID #:

Preburn [X] Test [ ] Coal Bed: Data: 0 = Ø 75 Range: 1.5 - 1.8 Actual: Coal Bed: 1.5

Time	Fuel Weight	Delta Weight	Stack Draft	TEMPERATURES (oF) Ambient	Top	Bottom	Back	Left	Right	Flue	Catalyst
0	11.9	—	-.050	76	456	102	528	396	431	383	NA
10	10.9	1.0	-.068	74	461	104	538	395	412	512	
20	8.3	2.7	-.075	72	628	108	751	444	480	608	
30	5.9	2.4	-.083	73	691	111	807	495	542	670	
40	3.5	2.4	-.081	75	769	114	880	557	611	711	
50	2.2	1.3	-.075	73	782	120	909	593	649	617	
60	1.7	0.5	-.065	72	702	127	764	606	638	510	
65 70	1.5	0.2	-.062	74	651	132	691	597	612	475	
80											
90											
00											
10											
20											
30											
40											
50											
60											
70											
80											
90											
AVG											

Technician signature: BQ Date: 10-12-05

8-15 of 8-28

OMNI-Test Laboratories, Inc.
Beaverton, OR

FUEL DATA

Client: Morso
Model: 8100
Project #: 192-S-07-3 Tracking #: 786
Date: 10-6-05 Test Crew: B Davis Run #: 2
OMNI Equipment ID #:
FUEL LOAD PREPARED BY: B Davis
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
Cal Value (2) = 22% Actual Reading 22

Piece	Length	Readings			Type
1	8 ft	22.4	21.2	21.6	2×4
2	8 ft	19.1	20.0	19.4	2×4
3	ft				
	4 @ 10				

Length of cut pieces: 8 @ 12.5 inches Pre-Burn Fuel Average Moisture: 20.62

Time (clock): 4:15 Room Temperature (F): 75 Initials: BD

TEST FUEL

FUEL TYPE AND AMOUNT: 2 × 4 7 4 × 4 0
CALCULATED LOAD WEIGHT: 7.35 ACTUAL LOAD WEIGHT: 7.5 (2 × 4)
0 (4 × 4)
7.5 Total

FUEL PIECE LENGTH: 12.5

MOISTURE CONTENT (METER – – DRY BASIS)

PIECE	READINGS			TYPE
1	21.1	21.4	19.3	2×4
2	20.1	18.8	18.8	2×4
3	22.7	23.2	23.8	2×4
4	22.0	22.0	22.6	2×4
5				
6				
7				
8				
9				
10				

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 21.27

Time (clock): 17:05 Room Temperature (F): 75 Initials: BD

Technician signature: B Davis Date: 10-12-05

OMNI-Test Laboratories, Inc.
Beaverton, OR

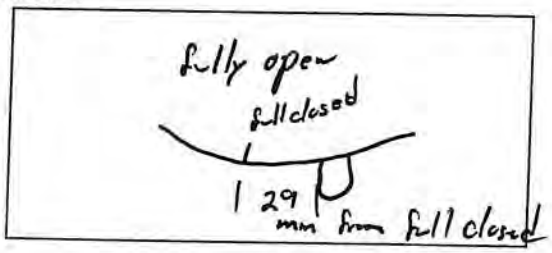
Run Notes

Client/Model: Morso
Model: 8100
Project #: 192-S-07-3
Tracking Number: 786
Run #: 2 Date: 10-6-05
Test Crew: BQ Aus
OMNI Equipment ID Numbers:

PREBURN

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

PRIMARY:



SECONDARY: fixed

TERTIARY: NA

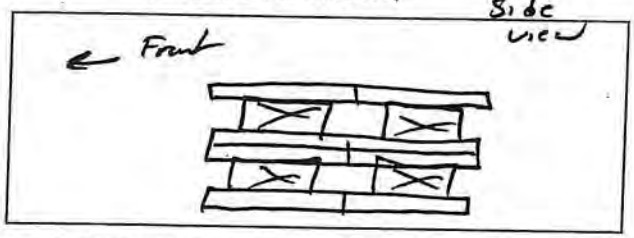
FAN: NA

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
Ø 66	Test setting				x	→

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)



START UP PROCEDURES

BYPASS: NA
FUEL LOADING by 25 sec
DOOR: cracked open until 2:10 then closed
PRIMARY AIR: fully open till 5:00
OTHER: NA

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

SECONDARY: fixed

TERTIARY: NA

FAN: NA

Technician signature: BQ Date: 10-12-05

OMNI-Test Laboratories, Inc.
Beaverton, OR

Supplemental Data EPA 5G/5H

Client: Morso

Model: 8100

Project No.: 192-S-07-3 Tracking No.: 786

Date: 10-6-05 Run No.: 2 Booth: 1

Test Crew: B. Davis Start Time: 18:01 Stop Time: 20:21

OMNI Equipment #'s: _____

Gas Analyzer Train Leak Check:

Stack:

Initial: NA

Final: _____

Dilution Tunnel (Method 5G Only):

Initial: _____

Final: _____

Calibrations: Span Gas CO_2: _____ O_2: _____ CO: _____ CO_2(DT): _____

	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span
Time	NA						
O_2							
CO_2							
CO							
CO_2 (DT)							

Stack Diameter (inches): 6"

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

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

Induced Draft: 0.0 %Smoke Capture: 100%

Pitot Tube Leak Test: Pre: 0.0 @ 3.2" Post: 0.0 @ 3"

Flue Pipe Cleaned Prior to First Test in Series: Date: 10-5-05 Initials: BD

	Initial	Middle	Ending
Pb (in. Hg)	29.82	29.82	29.82
Room Temp (°F)	74	74	72

Technician signature: _____ Date: 10-12-05

Model: 8140
Morsø Jernstøberi A/S
Furvej 6 DK-7900
Nykobing Mors
DENMARK

Run 3

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Run:	3
Manufacturer:	Morso
Model:	8100
Tracking No.:	786
Project No.:	192-S-07-3
Test Date:	07-Oct-05
Beginning Clock Time:	10:32
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	0.036	0.048	0.044	0.030	0.024	0.042	0.050	0.034	"H2O
Initial Temp.	100	100	100	100	100	100	100	100	oF

OMNI Equipment Numbers:

PM Control Module:	21
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:	0.988

Barometric Pressure:	Begin	Middle	End	Average
	29.84	29.84	29.85	29.84 "Hg

Signature/Date: BCJ 11-1-05

Tunnel Velocity:	13.51	ft/sec.
Intial Tunnel Flow:	141.9	scfm
Average Tunnel Flow:	142.3	scfm
Tunnel Area:	0.196	ft2
Post-Test Leak Check:	.008@6	cfm@"Hg
Fuel Moisture (dry basis)	19.83	%
Total Particulate:	16.8	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	Average Surface	Stack	Filter	Impinger exit	Ambient	Draft In. H2O
0	569.200		0.75	68	0	100	0.039		6.9		515	132	528	524	534	446.6	358	70	66	67	-0.048
10	574.350	0.51	0.75	79	1	109	0.039	103	5.5	-1.4	519	135	605	482	496	447.4	462	72	47	67	-0.063
20	579.510	0.52	0.75	88	1	113	0.039	102	3.6	-1.9	595	135	729	485	537	496.2	513	72	45	69	-0.068
30	584.660	0.51	0.75	93	1	114	0.039	101	1.9	-1.7	641	133	776	510	577	527.4	519	73	47	69	-0.066
40	589.910	0.53	0.75	96	1	110	0.039	102	1.2	-0.7	632	128	714	541	599	522.8	455	73	47	68	-0.059
50	595.340	0.54	0.75	98	1	105	0.039	104	0.9	-0.3	586	125	628	547	578	492.8	407	74	47	69	-0.057
60	600.350	0.50	0.75	99	1	102	0.039	96	0.7	-0.2	526	122	550	526	537	452.2	369	77	47	71	-0.051
70	605.650	0.53	0.75	100	1	101	0.039	101	0.6	-0.1	478	122	498	500	503	420.2	343	76	48	71	-0.048
80	610.850	0.52	0.75	101	1	99	0.039	99	0.5	-0.1	447	121	464	479	478	397.8	328	76	49	70	-0.046
90	616.070	0.52	0.75	101	1	97	0.039	99	0.3	-0.2	420	120	437	460	456	378.6	315	76	50	69	-0.044
100	621.340	0.53	0.75	102	1	97	0.039	100	0.2	-0.1	396	118	413	443	435	361.0	303	77	51	71	-0.043
110	626.581	0.52	0.75	100	1	95	0.039	99	0.0	-0.2	378	116	394	428	418	346.8	294	77	53	69	-0.042
Avg/Total	57.381	0.52	0.75	93.75		103.50	0.039	100.38								100		74.42	49.75		-0.053

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Manufacturer: Morso
Model: 8100
Project No.: 786
Tracking No.: 192-S-07-3
Run: 3
Test Date: 10/07/05

Burn Rate	1.42 kg/hr dry
Particulate Concentration (dry-standard) Particulate Emission Rate Adjusted Emissions	0.00031 grams/dscf 2.66 grams/hour 4.09 grams/hour
Average Tunnel Temperature	104 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	57.38 cubic feet 94 degrees Fahrenheit 13.51 feet/second 8540.94 dscf/hour 54.02 dscf
Total Particulates - mn Average Delta H Total Time of Test	16.8 mg 0.75 inches H20 110 minutes

Final Laboratory Report - Method 5G
Dilution Tunnel Particulate Calculations

Client Name: Morso
Model: 8100
Project No.: 192-S-07-3
Tracking No.: 786
Equipment Numbers:
Run #: 3
Date: 10/07/05

Sample Component	Reagent	Filter # or Volume, ml	Weights			
			Final, mg	Tare, mg	Blank, mg/ml	Particulate, mg
A. Front filter catch	Filter	M836	563.1	552.8		10.3
B. Rear filter catch	Filter	M835	548.7	548.9		-0.2
C. Rinse of probe and filter assembly	Acetone	75	116472.1	116465.3	0.0013	6.7

Total Particulate, mg :	16.8

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: Date: 10-12-05

... Laboratories, Inc.
Be... , OR ... ne (50... -3788

STOVE TEMPERATURE TEST DATA - METHOD 5G

Client/Model: Morso   Project #: 192-S-07-3   Tracking #: 786

Date: 10-7-05   Test Crew: B Davis   Run #: 3

OMNI Equipment ID #:

Preburn [X]
Test [ ]

Coal Bed Data: 0 = Ø   Range: 1.4 - 1.7   Actual Coal Bed: 1.7

Time	Fuel Weight	Delta Weight	Stack Draft	TEMPERATURES (oF) Ambient	Top	Bottom	Back	Left	Right	Flue	Catalyst
0	10.9	—	-.061	67	505	110	641	432	453	471	
10	9.0	1.9	-.064	67	573	110	728	464	509	501	
20	6.9	2.1	-.076	67	650	111	796	509	563	651	
30	4.9	2.0	-.078	68	725	110	853	540	600	701	
40	3.2	1.7	-.068	69	724	112	844	571	630	556	
50	2.3	0.9	-.063	67	684	117	774	587	634	477	
60	2.1	0.2	-.053	68	592	123	626	565	586	396	
70	1.8	0.3	-.050	68	539	129	562	537	549	367	
~~80~~ 75	1.7	0.1	-.048	67	522	131	542	527	536	358	
90											
00											
10											
20											
30											
40											
50											
60											
70											
80											
90											
AVG											

Technician signature: B D   Date: 10-12-05

OMNI-Test Laboratories, Inc.
Beaverton, OR

FUEL DATA

Client: Morso
Model: 8100
Project #: 192-S-07-3 Tracking #: 786
Date: 10-7-05 Test Crew: B Davis Run #: 3
OMNI Equipment ID #:
FUEL LOAD PREPARED BY: B Davis
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
Cal Value (2) = 22% Actual Reading 22

Piece	Length	Readings			Type
1	8 ft	23.2	22.4	22.8	2x4
2	8 ft	22.4	24.0	23.6	2x4
3	ft				

Length of cut pieces: 4@10 6@12.5 inches Pre-Burn Fuel Average Moisture: 23.07

Time (clock): 0850 Room Temperature (F): 67 Initials: BDL

TEST FUEL

FUEL TYPE AND AMOUNT: 2 × 4 4 4 × 4 0
CALCULATED LOAD WEIGHT: 7.35 ACTUAL LOAD WEIGHT: 6.9 (2 × 4)
0 (4 × 4)
FUEL PIECE LENGTH: 12.5 6.9 Total

MOISTURE CONTENT (METER -- DRY BASIS)

PIECE	READINGS			TYPE
1	19.1	18.8	20.0	2x4
2	19.5	21.0	20.9	2x4
3	21.4	19.3	20.2	2x4
4	19.5	18.3	19.9	2x4
5				
6				
7				
8				
9				
10				

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 19.83

Time (clock): 0950 Room Temperature (F): 70 Initials: BDL

Technician signature: B Davis Date: 10.8.05

OMNI-Test Laboratories, Inc.
Beaverton, OR

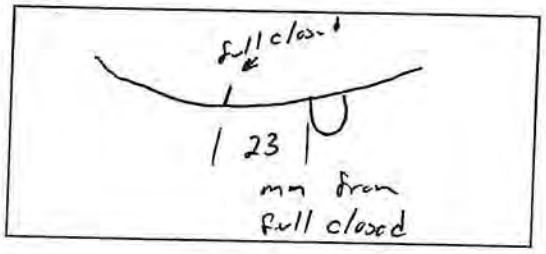
Run Notes

Client/Model: Morso
Model: 8100
Project #: 192-S-07-3
Tracking Number: 786
Run #: 3 Date: 10-7-05
Test Crew: BD Davis
OMNI Equipment ID Numbers:

PREBURN

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

PRIMARY:



SECONDARY: fixed

TERTIARY: NA

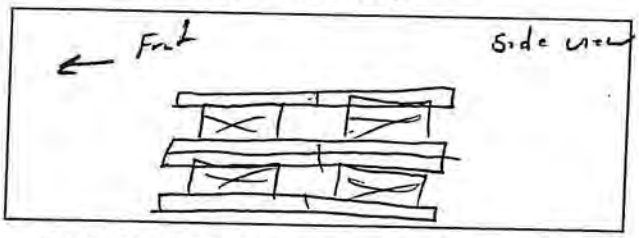
FAN: NA

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
Ø	Test setting					
76					X	→

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)



START UP PROCEDURES
BYPASS: NA
FUEL LOADING by 20 sec
DOOR: cracked open until 2:15 then closed
PRIMARY AIR: at test setting full 5:00
OTHER: NA

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

Same as Above

SECONDARY: fixed

TERTIARY: NA

FAN: NA

Technician signature: BD Date: 10-12-05

OMNI-Test Laboratories, Inc.
Beaverton, OR

Supplemental Data EPA 5G/5H

Client: Morso

Model: 8100

Project No.: 192-S-07-3 Tracking No.: 786

Date: 10-7-05 Run No.: 3 Booth: 1

Test Crew: BOAN Start Time: 10:32 Stop Time: 12:22

OMNI Equipment #'s: _____

Gas Analyzer Train Leak Check:

Stack:

Initial: NA

Final: _____

Dilution Tunnel (Method 5G Only):

Initial: _____

Final: _____

Calibrations: Span Gas CO_2: _____ 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
	NA						
O_2							
CO_2							
CO							
CO_2 (DT)							

Stack Diameter (inches): 6"

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

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

Induced Draft: 0.0 %Smoke Capture: 100%

Pitot Tube Leak Test: Pre: 0.0 @ 3.4 Post: 0.0 @ 3.1

Flue Pipe Cleaned Prior to First Test in Series: Date: 10-5-05 Initials: BA

	Initial	Middle	Ending
Pb (in. Hg)	29.84	29.84	29.85
Room Temp (°F)	84	71	69

Technician signature: _____ Date: 10-12-05

Model: 8140
Morsø Jernstøberi A/S
Furvej 6 DK-7900
Nykobing Mors
DENMARK

Run 4

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Run:	4
Manufacturer:	Morso
Model:	8100
Tracking No.:	786
Project No.:	192-S-07-3
Test Date:	07-Oct-05
Beginning Clock Time:	15:40
Recording Interval:	10 min.
Total Sampling Time:	140 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	0.030	0.050	0.042	0.032	0.028	0.046	0.050	0.034	"H2O
Initial Temp.	93	93	93	93	93	93	93	93	oF

PM Control Module:	21			
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:	0.988			
Barometric Pressure:	Begin	Middle	End	Average
	29.82	29.83	29.83	29.83 "Hg

Signature/Date: BQ 11-1-05

Tunnel Velocity:	13.52	ft/sec.
Intial Tunnel Flow:	143.7	scfm
Average Tunnel Flow:	144.1	scfm
Tunnel Area:	0.196	ft2
Post-Test Leak Check:	.004@6	cfm@"Hg
Fuel Moisture (dry basis)	20.16	%
Total Particulate:	11.2	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	Average Surface	Stack	Filter	Impinger exit	Ambient	Draft In. H2O
0	626.900		0.75	77	0	93	0.039		7.0		442	109	446	461	453	382.2	292	71	66	68	-0.045
10	632.090	0.52	0.75	82	1	113	0.039	104	5.4	-1.6	483	108	547	443	439	404.0	425	76	49	68	-0.057
20	637.250	0.52	0.75	90	1	104	0.039	102	4.3	-1.1	511	107	607	444	463	426.4	412	76	47	69	-0.058
30	642.510	0.53	0.75	95	1	105	0.039	103	3.0	-1.3	558	106	670	461	502	459.4	433	76	47	70	-0.058
40	647.630	0.51	0.75	98	1	105	0.039	99	1.9	-1.1	594	105	706	484	534	484.6	439	77	47	71	-0.058
50	652.900	0.53	0.75	100	1	103	0.039	102	1.3	-0.6	483	104	644	503	547	456.2	385	77	48	72	-0.052
60	658.120	0.52	0.75	102	1	98	0.039	100	1.2	-0.1	530	103	555	502	522	442.4	340	77	49	71	-0.048
70	663.370	0.53	0.75	102	1	96	0.039	100	1.0	-0.2	489	103	504	485	494	415.0	318	77	49	71	-0.045
80	668.570	0.52	0.75	103	1	95	0.039	99	0.8	-0.2	455	103	468	467	469	392.4	303	76	50	71	-0.042
90	673.830	0.53	0.75	103	1	93	0.039	100	0.7	-0.1	429	102	443	452	451	375.4	292	76	49	70	-0.040
100	679.200	0.54	0.75	104	1	91	0.039	102	0.5	-0.2	408	103	423	439	437	362.0	283	76	50	72	-0.038
110	684.330	0.51	0.75	103	1	90	0.039	97	0.4	-0.1	394	103	410	430	428	353.0	277	76	50	70	-0.038
120	689.610	0.53	0.75	103	1	89	0.039	100	0.3	-0.1	382	102	399	422	418	344.6	271	75	50	68	-0.037
130	694.820	0.52	0.75	103	1	88	0.039	99	0.1	-0.2	373	102	390	415	411	338.2	266	74	50	70	-0.037
140	700.060	0.52	0.75	102	1	88	0.039	99	0.0	-0.1	363	101	378	406	402	330.0	261	74	50	69	-0.036
Avg/Total	73.160	0.52	0.75	97.80		96.73	0.039	100.53								52		75.60	50.07		-0.046

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Manufacturer: Morso
Model: 8100
Project No.: 786
Tracking No.: 192-S-07-3
Run: 4
Test Date: 10/07/05

Burn Rate	1.13 kg/hr dry
Particulate Concentration (dry-standard) Particulate Emission Rate Adjusted Emissions	0.00016 grams/dscf 1.42 grams/hour 2.43 grams/hour
Average Tunnel Temperature	97 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) - Vmst	73.16 cubic feet 98 degrees Fahrenheit 13.52 feet/second 8645.89 dscf/hour 68.33 dscf
Total Particulates - mn Average Delta H Total Time of Test	11.2 mg 0.75 inches H20 140 minutes

Final Laboratory Report - Method 5G
Dilution Tunnel Particulate Calculations

Client Name: Morso
Model: 8100
Project No.: 192-S-07-3
Tracking No.: 786

Equipment Numbers:

Run #: 4
Date: 10/07/05

Sample Component	Reagent	Filter # or Volume, ml	Weights			
			Final, mg	Tare, mg	Blank, mg/ml	Particulate, mg
A. Front filter catch	Filter	M838	552.3	545.5		6.8
B. Rear filter catch	Filter	M837	542.3	543.8		-1.5
C. Rinse of probe and filter assembly	Acetone	100	104400.0	104394.0	0.0013	5.9

Total Particulate, mg :	11.2

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: Date: 10-12-05

STOVE TEMPERATURE TEST DATA - METHOD 5G

Client/Model: Morso Project #: 192-S-07-3 Tracking #: 786

Date: 10-7-05 Test Crew: B Davis Run #: 4

OMNI Equipment ID #:

Preburn [X] Test [ ] Coal Bed: Data: 0 = Ø 7.0 Range: 1.4-1.7 Actual: Coal Bed: 1.7

Time	Fuel Weight	Delta Weight	Stack Draft	TEMPERATURES (oF) Ambient	Top	Bottom	Back	Left	Right	Flue	Catalyst
0	5.8	/	-080	71	728	107	882	542	598	648	
10	4.3	1.5	-063	70	684	109	766	565	607	456	
20	3.2	1.1	-060	69	634	111	703	559	590	408	
30	2.6	0.6	-053	68	601	110	656	549	576	367	
40	2.3	0.3	-047	67	556	109	590	528	545	332	
50	2.2	0.1	-044	67	513	109	532	506	514	305	
60	1.8	0.4	-040	69	471	109	482	480	477	285	
67 70	1.7	0.1	-038	68	448	109	456	463	456	275	
80											
90											
00											
10											
20											
30											
40											
50											
60											
70											
80											
90											
AVG											

Technician signature: BD Date: 10-12-05

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OMNI-Test Laboratories, Inc.
Beaverton, OR

FUEL DATA

Client: Morso
Model: 8100
Project #: 192-S-07-3 Tracking #: 786
Date: 10-7-05 Test Crew: B Davis Run #: 4
OMNI Equipment ID #:
FUEL LOAD PREPARED BY: B Davis
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
Cal Value (2) = 22% Actual Reading 22

Piece	Length		Readings		Type
1	8 ft	23.3	23.2	21.0	2x4
2	8 ft	18.5	20.1	19.4	2x4
3	ft				

4 @ 10

Length of cut pieces: 6 @ 12.5 inches Pre-Burn Fuel Average Moisture: 20.92

Time (clock): 12:55 Room Temperature (F): 71 Initials: BD

TEST FUEL

FUEL TYPE AND AMOUNT: 2 × 4 4 4 × 4 0
CALCULATED LOAD WEIGHT: 7.35 ACTUAL LOAD WEIGHT: 7.0 (2 × 4)
0 (4 × 4)
FUEL PIECE LENGTH: 12.5 7.0 Total

MOISTURE CONTENT (METER – – DRY BASIS)

PIECE	READINGS			TYPE
1	18.8	19.2	19.3	2x4
2	19.5	19.7	18.6	2x4
3	21.9	22.0	23.0	2x4
4	20.1	20.1	19.7	2x4
5				
6				
7				
8				
9				
10				

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 20.16

Time (clock): 15:10 Room Temperature (F): 72 Initials: BD

Technician signature: B. Davis Date: 10-20-05

OMNI-Test Laboratories, Inc.
Beaverton, OR

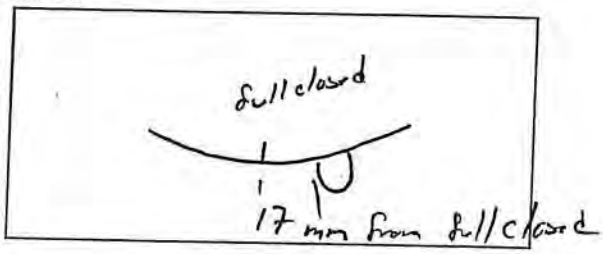
Run Notes

Client/Model: Morso
Model: 8100
Project #: 192-S-07-3
Tracking Number: 786
Run #: 4 Date: 10-7-05
Test Crew: BJ Davis
OMNI Equipment ID Numbers:

PREBURN

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

PRIMARY:



SECONDARY: fixed

TERTIARY: NA

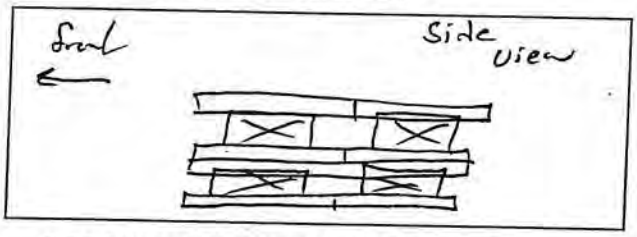
FAN: NA

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					
51				-.3		
68					X	

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)



START UP PROCEDURES

BYPASS: NA
FUEL LOADING by 25 sec
DOOR: cracked open until 4:00 then closed
PRIMARY AIR: fully open until 4:00 Then slowly set to test setting by 5:00
OTHER: NA

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

Same as Above

SECONDARY: fixed

TERTIARY: NA

FAN: NA

Technician signature: BJD Date: 10-12-05

OMNI-Test Laboratories, Inc.
Beaverton, OR

Supplemental Data EPA 5G/5H

Client: Morso

Model: 8100

Project No.: 192-S-07-3 Tracking No.: 786

Date: 10-7-05 Run No.: 4 Booth: 1

Test Crew: BD DOS Start Time: 15:40 Stop Time: 18:00

OMNI Equipment #'s: _____

Gas Analyzer Train Leak Check:

Stack: Dilution Tunnel (Method 5G Only):

Initial: NA Initial: _____

Final: _____ Final: _____

Calibrations: Span Gas CO_2: _____ O_2: _____ CO: _____ CO_2(DT): _____

	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span	N_2 Span
Time	NA						
O_2							
CO_2							
CO							
CO_2 (DT)							

Stack Diameter (inches): 6"

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

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

Induced Draft: 0.0 %Smoke Capture: 100%

Pitot Tube Leak Test: Pre: 0.0 @ 3.0 Post: 0.0 @ 3.2

Flue Pipe Cleaned Prior to First Test in Series: Date: 10-5-05 Initials: DR

	Initial	Middle	Ending
Pb (in. Hg)	29.82	29.83	29.83
Room Temp (°F)	68	71	69

Technician signature: _____ Date: 10-12-05

Model: 8140
Morsø Jernstøberi A/S
Furvej 6 DK-7900
Nykobing Mors
DENMARK

Section 3

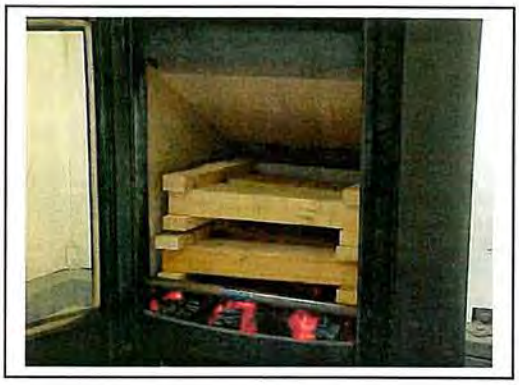
Drawings and Fuel Photographs

Model: 8140
Morsø Jernstøberi A/S
Furvej 6 DK-7900
Nykobing Mors
DENMARK

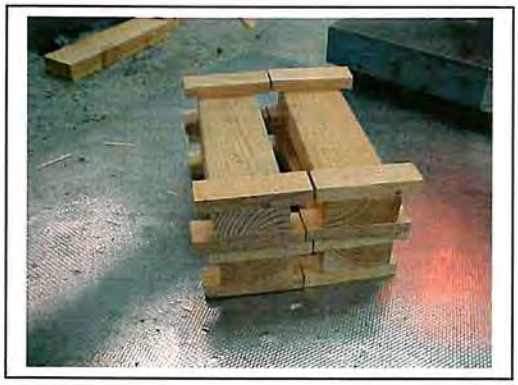
Morsø Jernstøberi A/S
Model: 8140

Run 1 - Fuel

Run 1 - Newly Loaded Stove



Run 2 - Fuel



Run 2 – Newly Loaded Stove

Model: 8140
Morsø Jernstøberi A/S
Furvej 6 DK-7900
Nykobing Mors
DENMARK

Morsø Jernstøberi A/S
Model: 8140

Run 3 - Fuel

Run 3 – Newly Loaded Stove

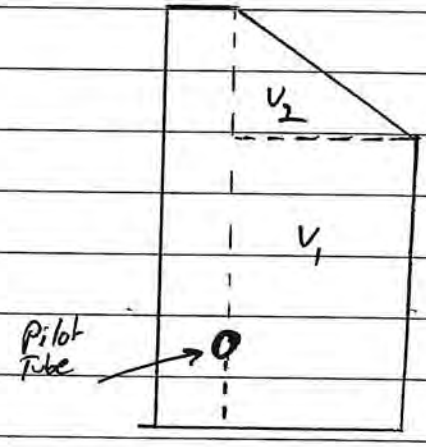
Run 4 - Fuel

Run 4 – Newly Loaded Stove

NOTES

Firebox Volume

Morso 8100 series



	H	W	D	ft^3
V_1 =	10.25	13.75	10.25	= .836
V_2 =	5.25 / 2	13.75	10.25	.214
				1.05 ft^3

Fuel load = 7.35 lbs

± 10% 6.7 - 8.1

Project Number: 192-S-07-3

Technician Initialed: BR

Date: 11-1-05

OMNI ID: 786

Morsø 8100 series NA - Drawings and data

Nykøbing Mors d. 27.10.2005

PARTS:	DRAWINGS:	DATE:
Base plate, inside	8100-01	22.11.04
Top frame	8100-02	22.11.04
Door	8100-03	18.11.04
Side plate, inside	8100-04	16.11.04
Rear plate, inside	8100-05	16.11.04
Top plate, inside	8100-06	17.11.04
Top frame	8100-07	26.10.05
Side plate, outside	8100-08	24.11.04
Rear plate, outside	8100-09	24.11.04
Top plate, outside	8100-10	11.11.04
Socle, high	8100-11	22.11.04
Base plate, outside	8100-12	22.11.04
Intermediate frame	8100-13	23.11.04
Air canal, front	8100-15	23.11.04
Air canal, rear	8100-16	18.11.04
Air canal, top	8100-17	18.11.04
Leg	8100-18	24.11.04
Drawer, front	8100-19	25.11.04
Cover	8100-20	25.11.04
Cover plate, rear, for leg	8100-21	24.11.04
Ceramic glass	8100-24	29.09.04
Brick, back	8100-26	25.01.05
Brick, side, right	8100-27	12.09.05
Brick, side, left	8100-28	07.09.05
Fitting f. hinge pin	8100-30	13.01.05
Distance tube	8100-31	18.01.05
Distance tube	8100-32	18.01.05
Radiant shielding, bottom	8100-33	19.01.05
Closing plate f. sek. draught control	8100-37	18.01.05
Handle f. sek. draught control	8100-38	21.12.04
Tertiary box	8100-41	18.01.05
Baffle plate, bottom	8100-42	07.09.05
Baffle plate, top	8100-43	19.09.05
Fitting plate f. baffle	8100-50	18.01.05
Ash tray	8100-52	24.01.05
Cover plate f. drawer section	8100-60	20.01.05
Fitting f. closing plate	8100-63	25.02.05
Drawer, box	8100-64	21.01.05
Radiant shielding, rear	8100-65	19.01.05
Mounting plate, drawer section	8100-66	21.01.05
Bush	8100-71	31.01.05
Fitting f. cover	8100-73	02.02.05
Soap stone top	8100-74	16.03.05
Soap stone side 8150	8100-75	14.03.05
Mointing plate f. soap stone	8100-76	14.03.05
Flat bar f. soap stone	8100-77	10.03.05
Soap stone side 8151	8100-78	15.03.05
Handle f.sek. draught control soap stone	8100-79	11.03.05
Back plate steel f. 8150	8100-80	11.03.05
Flat bar f. soap stone brick	8100-81	11.03.05
Back plate steel f. 8151	8100-83	11.03.05
App. drawing 8140	8100-102	24.10.05
App. drawing 8142	8100-103	24.10.05
App. drawing 8150	8100-105	25.10.05
App. drawing 8151	8100-106	25.10.05
App. drawing 8147	8100-120	25.10.05
Fitting f. airtight	8100-126	03.10.05
Pipe grate	8100-127	24.10.05
Sek. draught control	8100-128	24.10.05
Tightening tape	8100-130	27.10.05
Air flow	8100-129	26.10.05
Parts drawing	8100-501	26.10.05
Glass fitting	1124-29	23.02.93
Cover	1126-16	12.05.87
Knob f. riddling bar	1126-26	10.08.99
Bush	1126-27	02.07.01
Riddling handle	1126-42	30.06.87
Distance tube	1126-71	21.11.03
Air adaptor	1400-87	24.08.04
Distance tube	1400-300	13.01.97
Hinge pin	2000-186	11.05.05
Riddling grate	2100-66	22.03.99
Stainless Steel Handle	2100-158	29.05.01
Stainless Steel Handle	2100-159	26.01.01
Hinge pin	2100-174	26.01.04
Flue collar	3400-97	13.03.02
Ball barrel	4500-51	16.09.05
Flat bar	5000-63	05.09.05
Distance tube	5000-64	14.02.97
Hinge pin	5000-85	31.07.03
Round plate	5000-91	02.02.05
Stop fitting, left	7100-39	27.01.05
Stop fitting, right	7100-40	27.01.05
Riddling bar	Steel-15	23.09.02

V-1100 (600) Vermiculite insulating slabs- Technical datas
Glas fiber products – Technical datas
Glass ceramics - Technical datas
Installation and Operating Instructions
Parts list 8140, 8142

3-5 of 3-103

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.

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

March 2004

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STEFFCA TEXTILGLAS TEKNOLOGI - TEKNISK ISOLERING

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

"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 – Falstervej 10 H – 5800 Nyborg – A/S Reg. Nr. 24 44 93 – CVR. Nr. 20 76 85 09
Telefon +45 6531 3102 – Telefax +45 6531 8502 - E-mail info@steffca.dk – 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%

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

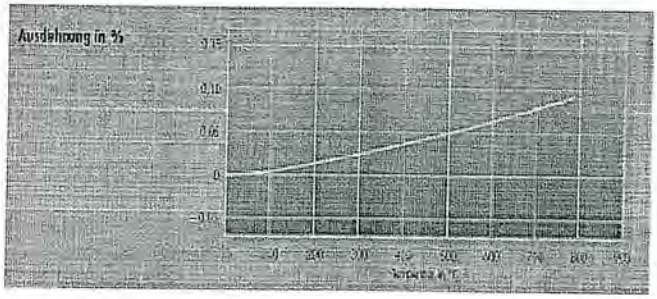
Glass ceramics NEOCERAM N-0
Technical datas
Thermal expansion
Light transmission

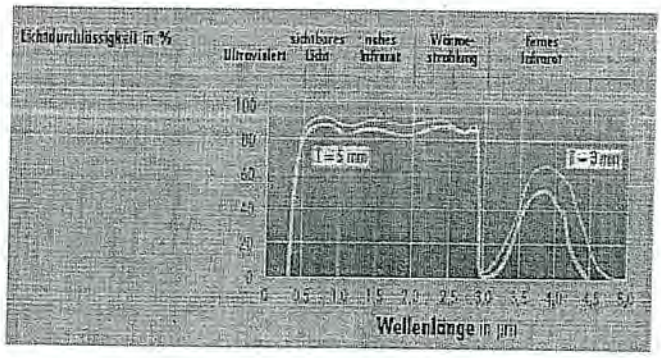
Surface character

Flat glasses/Coated glass ceramics/Installation instructions

Technical datas

Expansion coefficient	· 10-7/K	(30 - 380° C) – 6 (30 - 750° C) – 3
Thermal shock resistance	°C	800
Maximum service temperature	°C	long term 700 short term 800
Thermal conductivity	W/m · K (25° C)	1,51
Specific heat	J/kg · K	712
Density	g/cm3	2,51
Bending and impact strength	correspondent to the datas of casting glass	





8100 - Reservedelsliste

* Revideret: 25.10.05 KDU

Posnr.	Parts:	Beskrivelse:	8140 NA 64810621	8142 NA m. skuffe 64810721
1	Top plate, outside	Topplade udv. 8100	448110xx	448110xx
2	Top frame	Topramme 8100	448107xx	448107xx
3	socle, high	Høj sokkel 8140	348111xx	%
* 4	Front frame	Forramme 8100	448131xx	448131xx
5	Door	Fyrdør 8100	448103xx	448103xx
6	Side plate, right	Sideplade indv. Højre 8100	44810400	44810400
7	Side plate, left	Sideplade indv. Venstre 8100	44812300	44812300
8	Rear plate, inside	Bagplade indv. 8100	44810500	44810500
9	Base plate, inside	Bundplade indv. 8100	44812200	44810100
10	Top plate, inside	Topplade indv. 8100	44810600	44810600
11	Side plate, outside	Sideplade udv. 8100	448108xx	448108xx
12	Rear plate, outside	Bagplade udv. 8100	448109xx	448109xx
13	Intermediate frame	Mellembund 8100	34811300	34811300
14	Brick, back	Sten bag	79810200	79810200
15	Brick, side, right	Sten side - Højre	79810300	79810300
16	Brick, side, left	Sten side - Venstre	79810400	79810400
* 17	Flue collar	Røgtud	443441xx	443441xx
19	Stop bar	Kuglespærre 4500	544541	544541
20	Screw	M6x30 Din933 - sort	731630	731630
21	Ceramic glass	Glas 8100	79810100	79810100
22	Cover	Dæksel 1126	442610xx	442610xx
23	Flat bar	Fladjern 3x10mm L=168mm	545006	545006
24	Distance tube	Afstandsrør ø10x1 L=8,5	545007	545007
25	Screw	M6x20 Din933 -sort	731620	731620
27	Air canal, rear	Luftkanal bag 8100	44811600	44811600
28	Air adaptor	Airtightstuds 8100	44142600	44142600
29	Air canal, top	Luftkanal top 8100	448117xx	448117xx
30	Washer	6mm Din9021 - fzb	791891	791891
31	Screw	M6x25 Din933 - sort	731625	731625
32	Screw	M6X08 Din933 - sort	731608	731608
33	Glass fitting	Glasclips 1124	790743	790743
34	Screw	M5x08 Din7985 - fzb	742508	742508
35	Riddling grate	Rysterist 2100	44182800	44182800
* 36	Sek. draught control	Sekundær spjæld 8100	71814400	71814400
37	Handle f. sek. draught control	Greb sek. spjæld	71810761	71810761
38	Screw	M5x10 Buttonhead - sort	73851000	73851000
39	Closing plate	Lukkeplade for	71810600	71810600
40	Air canal, front	Luftkanal front 8100	44811500	44811500
41	Tertiary box	Tertiær boks	71810861	71810861
42	Baffle plate, bottom	Sten over tertiærboks	79810500	79810500
43	Cover	Dæksel 8100	448120xx	448120xx
44	Baffle plate, top	Røgvendeplade øverst	79810600	79810600
45	Distance tube	Afst.rør ø12x1,5	71810300	71810300
46	Distance tube	Afstandsstykke ø8x1 L=9mm	71810200	71810200
47	Screw	06x20 Sætskrue Din933 - A2	74162000	74162000
48	Screw	M6x35 Din933 - sort	731635	731635
49	Fitting plate	Befæstigelsesplade	71811161	71811161
50	Screw	M6x45 Din933 - sort	731645	731645
51	Screw	M6X10 Din933 - sort	731610	731610
52	Riddling bar	Rystestang Ø-6	53001500	53001500
53	Bush	Messingbøsning	752621	752621
54	Knob f. riddling bar	Knop f. rystestang 1126	752619	752619
55	Ash tray	Askeskuffe 8100	71811300	71811300
58	Bush	Bøsning f. 1126 håndtag	71813061	71813061
59	Hinge pin	Hængselsstift ø6X35 MM	541808	541808
60	Screw	M6x06 Pinolskrue Din916-45H	739606	739606
61	Screw	M4x05 Pinolskrue Din916-45H	739405	739405
62	Washer	6mm Skive 6,4x12x1,6 Din 125A - fzb	746106	746106
63	Handle	Rustfri dørgreb 1126	75262800	75262800
64	Fitting f. closing plate	Beslag f. lukkepal	71813300	71813300
66	Hinge pin	Hængselsbeslag	71810100	71810100
67	Screw	M5x10 Iso7380	73851100	73851100
68	Screw	M6x10 Din965A - A2	74361000	74361000

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8100 - Reservedelsliste

Revideret: 25.10.05 KDU

Posnr.	Parts:	Beskrivelse:	8140 NA 64810621	8142 NA m. skuffe 64810721
69	Radiant shielding, bottom	Stråleplade bund	71810400	71810400
70	Distance tube	Afstandsrør ø10x1	542641	541439
71	Washer	06mm Vistop klemskive	746206	746206
72	Radiant shielding, rear	Stråleplade bag	71811400	71811400
73	Distance tube	Afstandsrør ø10x1 L=10	541439	541439
74	Screw	M6X16 Din933 - sort	731616	731616
75	Stop fitting, left	Stopbeslag - venstre	71711200	71711200
76	Stop fitting, right	Stopbeslag - højre	71711300	71711300
77	Fitting f. cover	Lus f. dæksel	71813200	71813200
78	Round plate	Rundel ø 200mm	545010	545010
79	Hinge pin	Hængselsstift ø5x110	54501800	54501800
80	Hinge pin	Hængselsstift ø5x75	545008	545008
82	Screw	M6x20/M6x45 Din933 - sort	731645	731620
83	Bottom plate, outside socle	Bundplade udv. 8142	%	448112xx
84	Bottom plate, outside socle	Bundplade udv. Sokkel 8100	%	448127xx
85	Leg	Ben 8100	%	448118xx
86	Cover plate, rear, for leg	Dækplade bag v. ben 8100	%	348121xx
87	Rubber stop block	Gummistopklods 8100	%	79082007
88	Screw	M6x12 Din7985	%	742612
89	Drawer, front	Skuffefront 8100	%	448119xx
90	Drawer, box	Skuffekasse 8100	%	718127xx
91	Cover plate f. drawer section	Afdækningsplade skuffesektion 8100	%	718126xx
92	Mounting plate, drawer section	Mont.plade skuffesekt. 8100	%	718128xx
93	Ball barrel	Kugleløb 27x310mm - elg.	%	79082006
94	Screw	M6x08 Buttonhead - sort	%	73860800
95	Screw	4,8x9,5 Din7981 pladeskrue - fzb	%	74400600
96	Screw	M4x08 din965A - fzb	%	74241800
97	Side plate, steel	Stålsideplade 8145	%	%
98	Rear plate, steel	Stålbagplade 8145	%	%
99	Socle, high	Sokkel f. 8145	%	%
100	Brace f. steel side plate	Seler f. stålplader 8145	%	%
101	Fitting f. steel side plate	Beslag f. stålsideplade 8145	%	%
102	Fitting f. steel rear plate	Beslag f. stålbagplade 8145	%	%
103	Screw	M6x35 Din933 - Sort	%	%
104	Screw	M6x12 Din933 - Sort	%	%
105	Tightening tape	Glasbånd m. tape 4x8mm sort	79074200	79074200
106	Screw	M5X16 Pinolskrue indv. 6kt. Din 913	73951600	73951600
107	Washer	6mm Skive Din522C - fzb	736106	736106
108	Screw	M6X50 Maskinbolt Din931 - Sort	731650	731650
109	Screw	6mm Skive 6,4x12x1,6 Din125A - fzb	%	746106
110	Feder	Bladfjeder fyrdør 8100	%	%
111	Feder fitting	Fjederbeslag fyrdør 8100	%	%
112	Screw	M4x6 DIN 912 - sort	%	%
113	Screw	M5x6 ISO7380	%	%
114	Screw	Skrue f. lus	743625	743625
115	Fitting f. airtight	Lus f. airtightstuds 8100	542642	542642
116	Screw	M6x16 ISO 7381 - sort	73861400	73861400
117	Pipe grate	Rørforrist 8100 NA	71814361	71814361
118	Screw	M6x12 Iso 7380 - sort	73861100	73861100

Farvekode: xx

21	Sort
22	Grå

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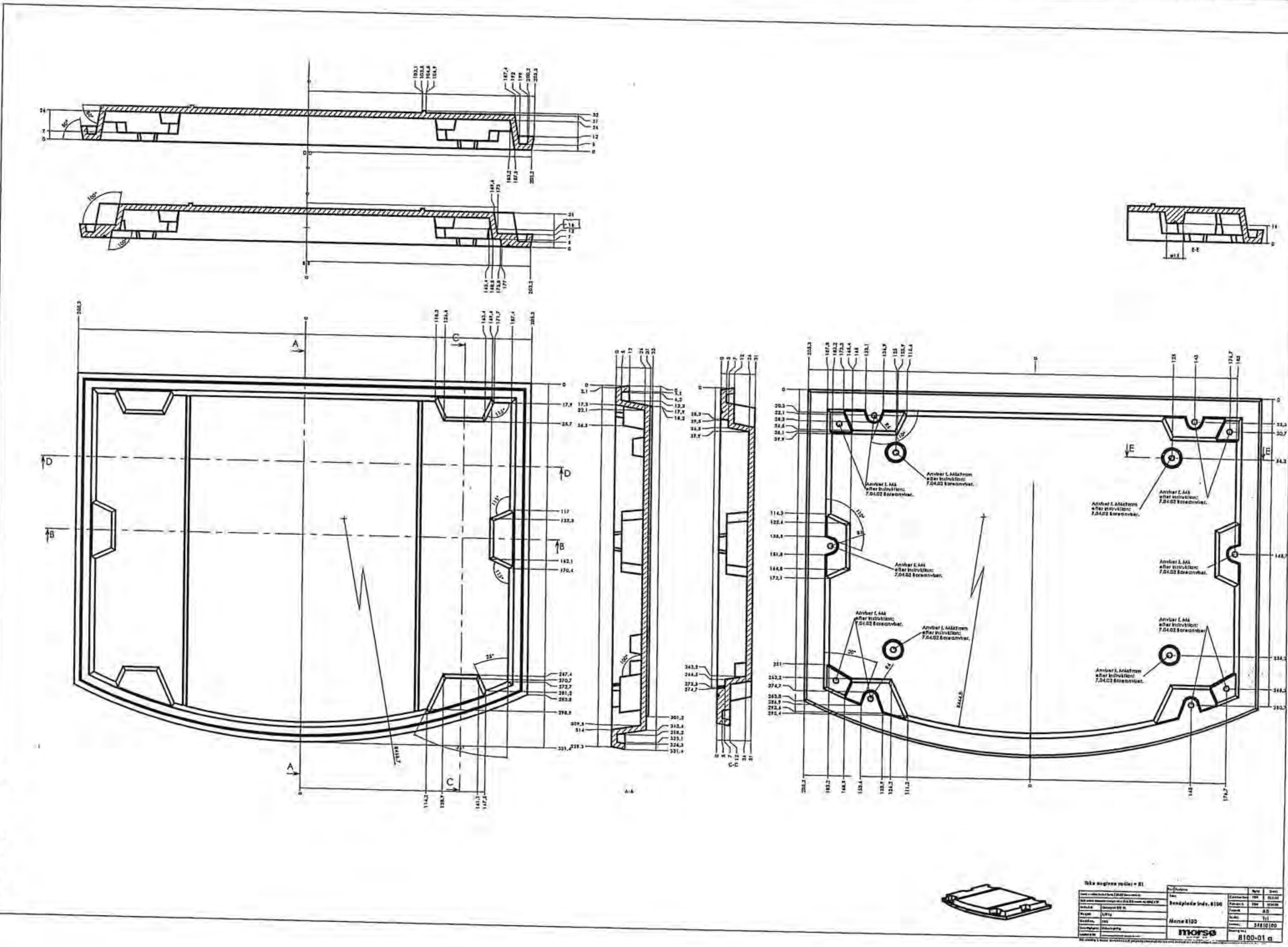

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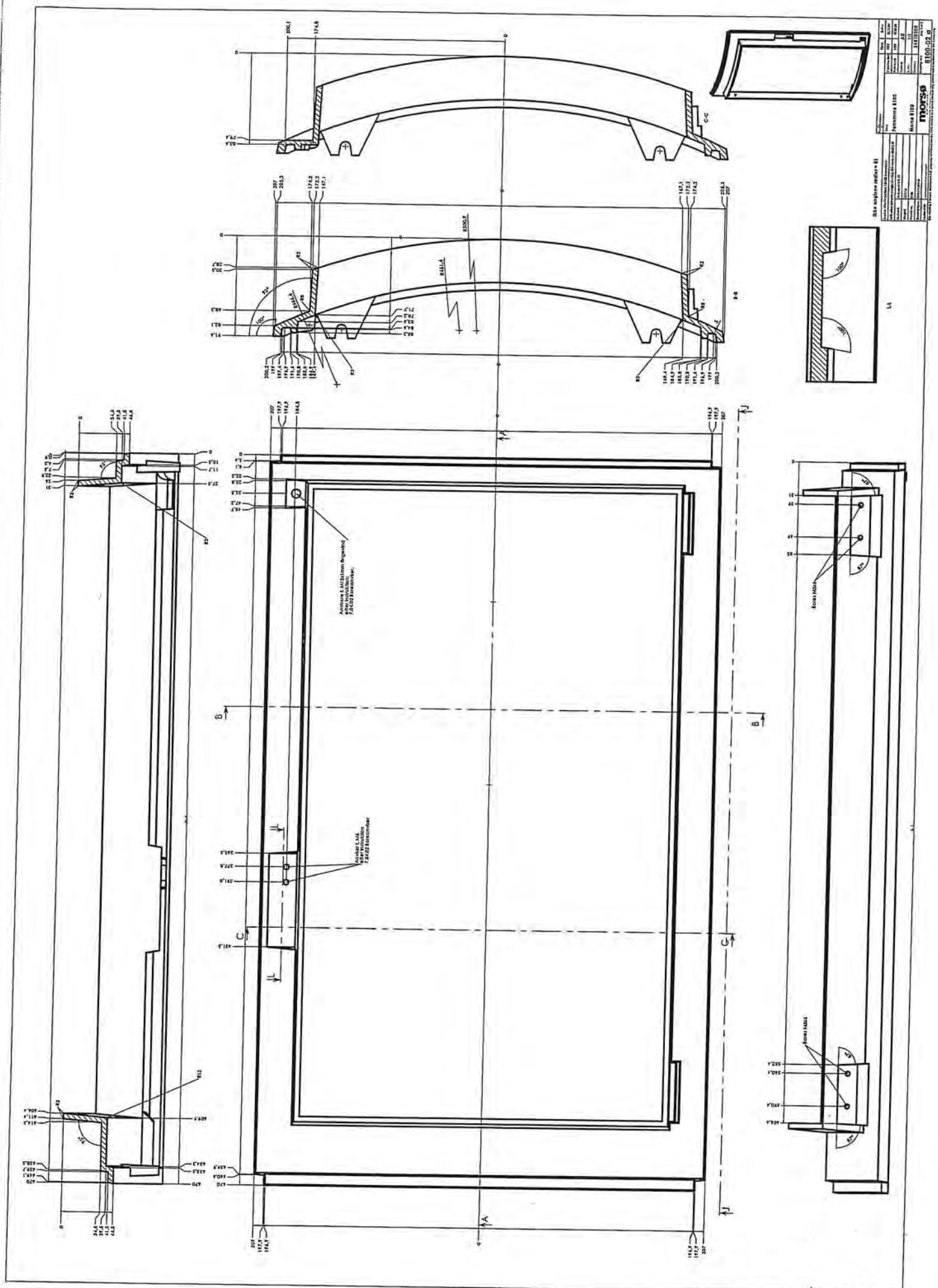
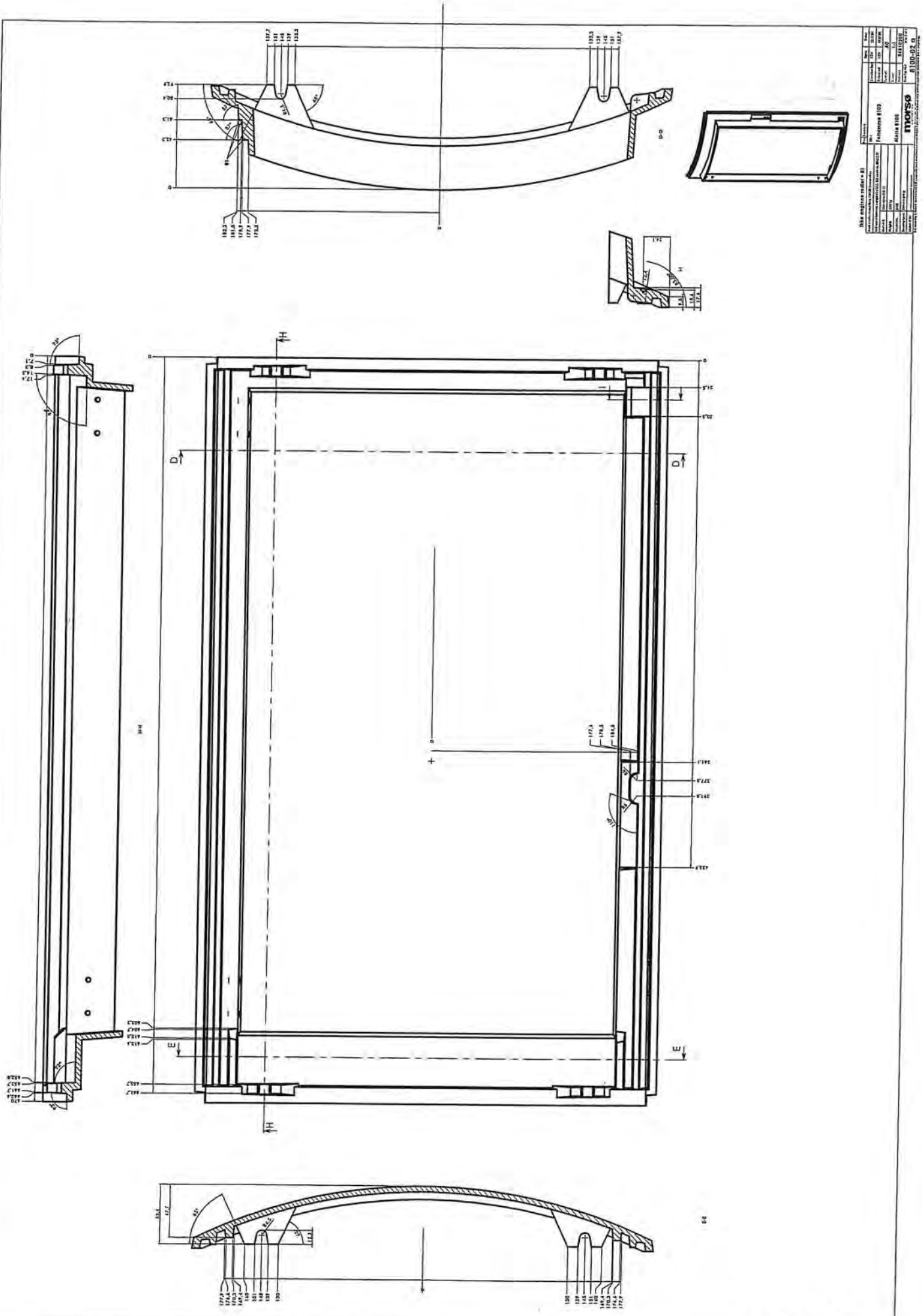
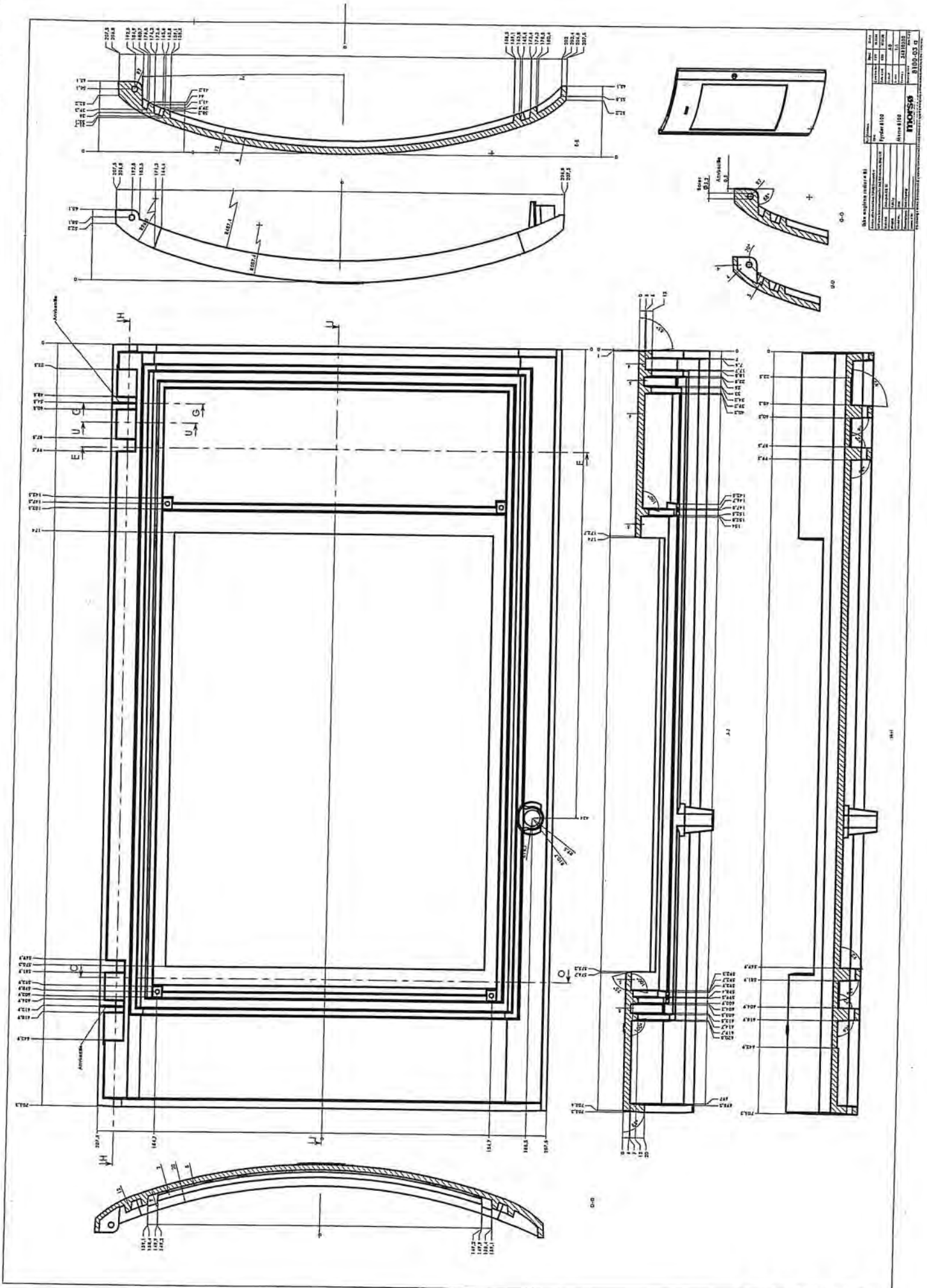
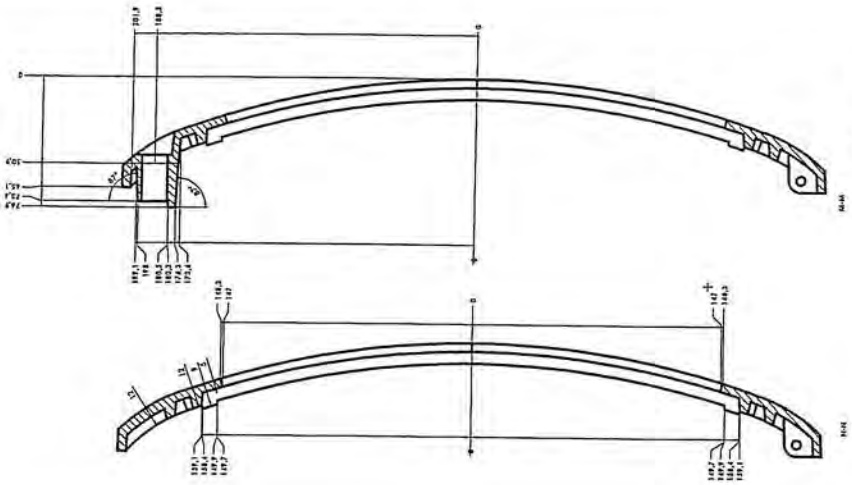
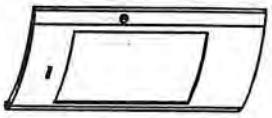
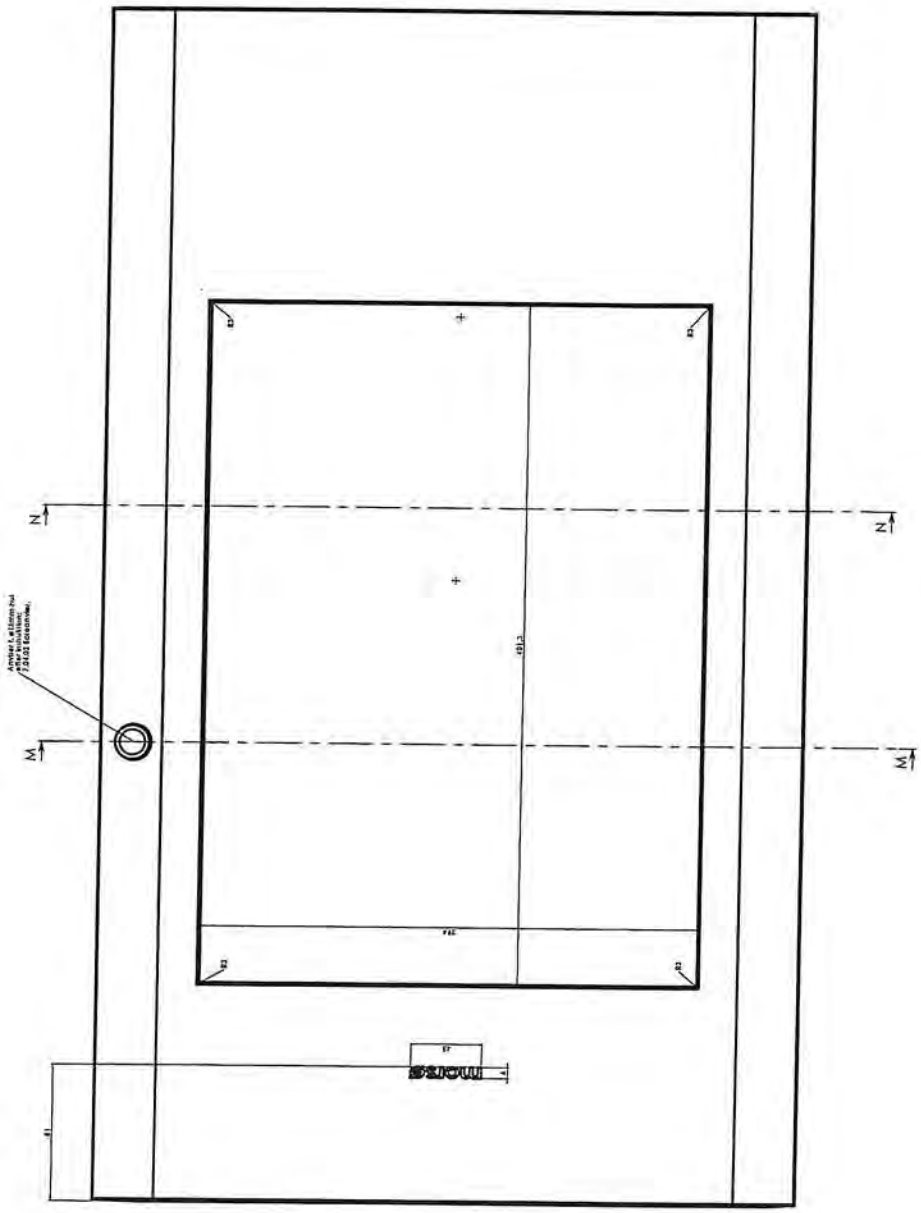


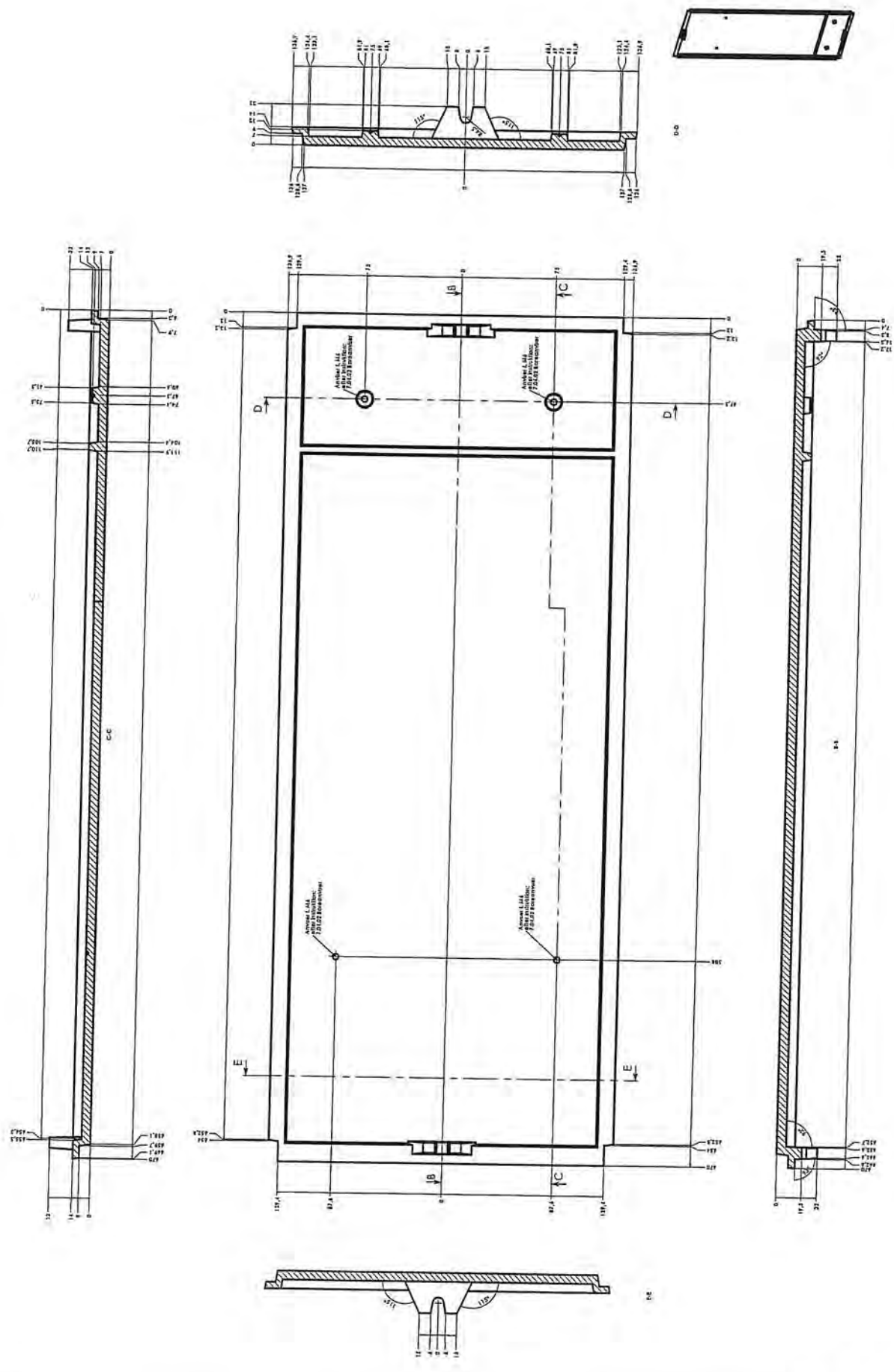


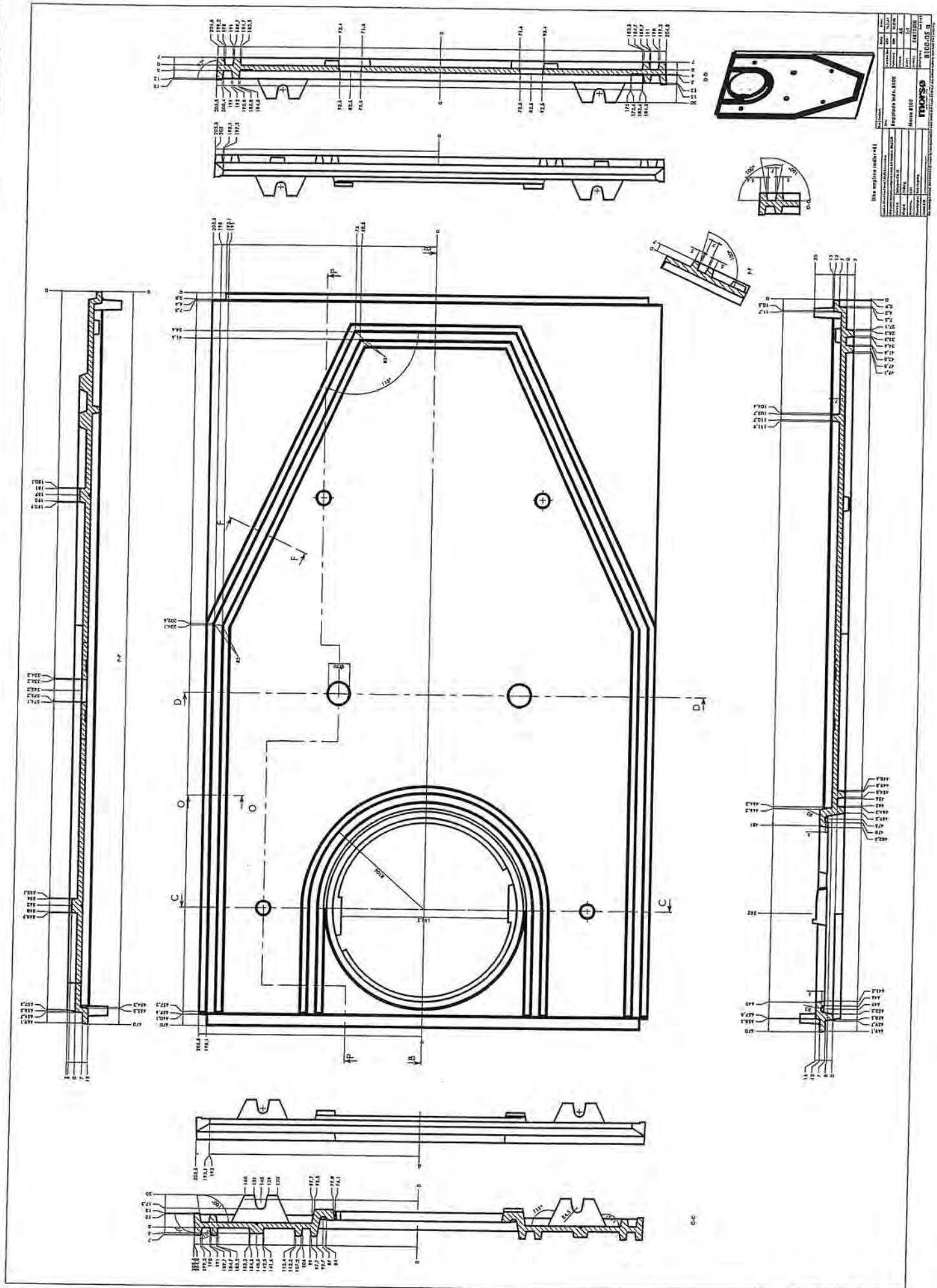


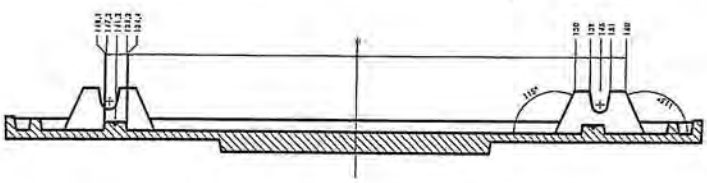


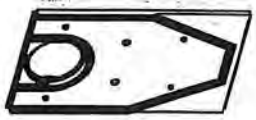


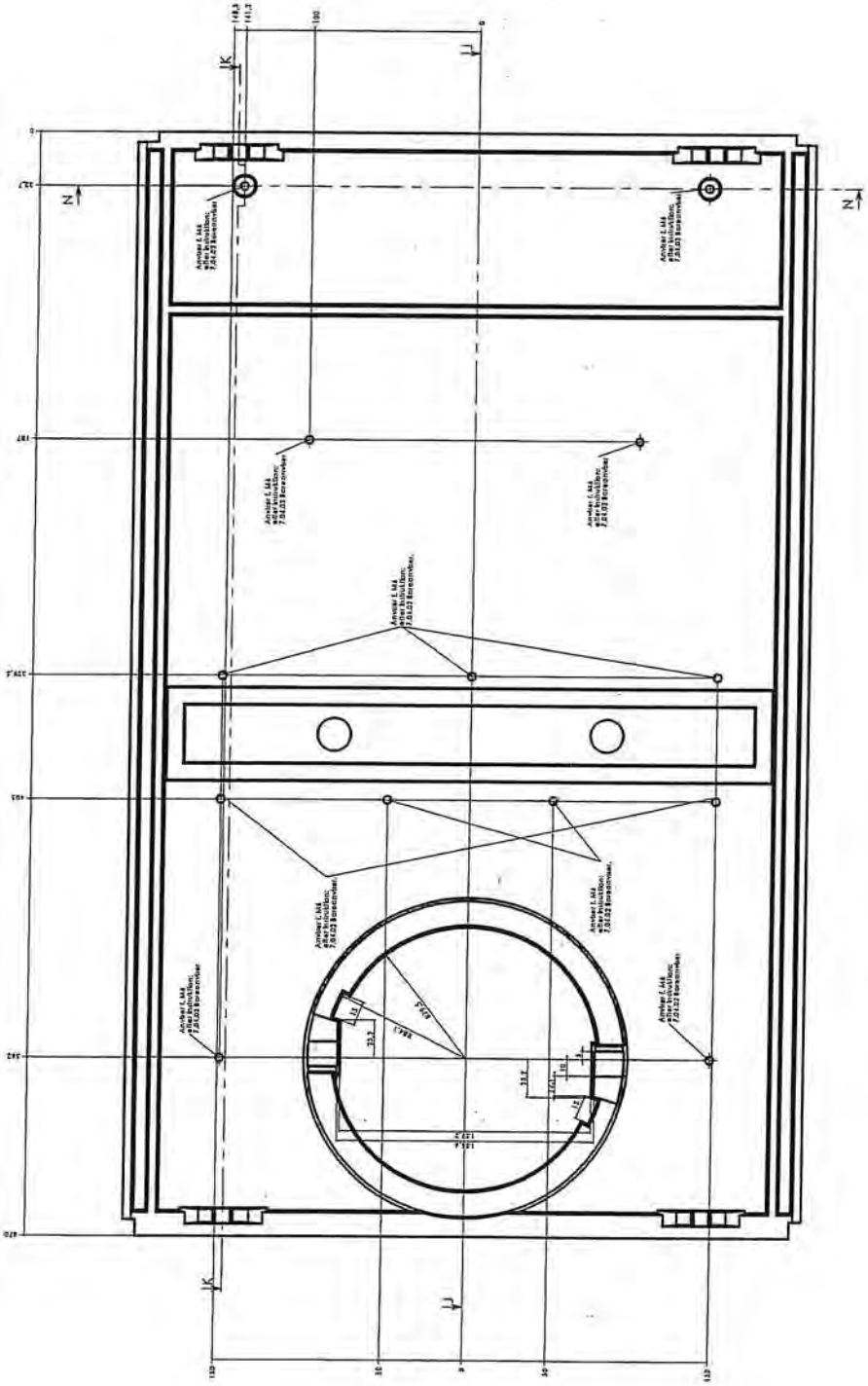


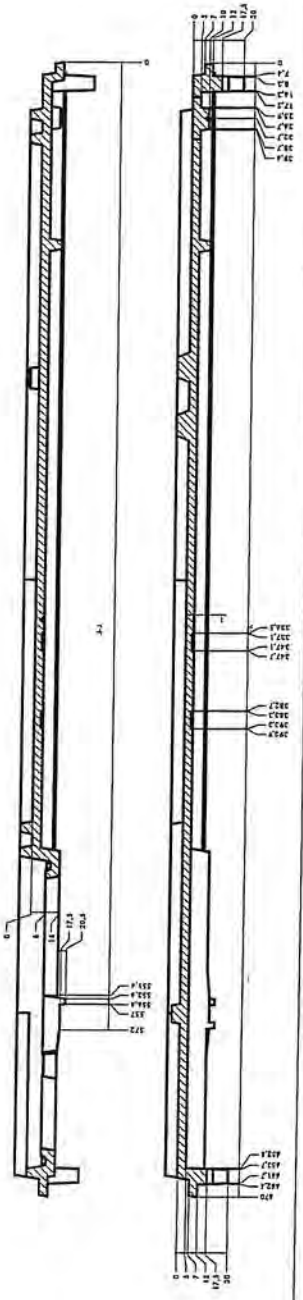


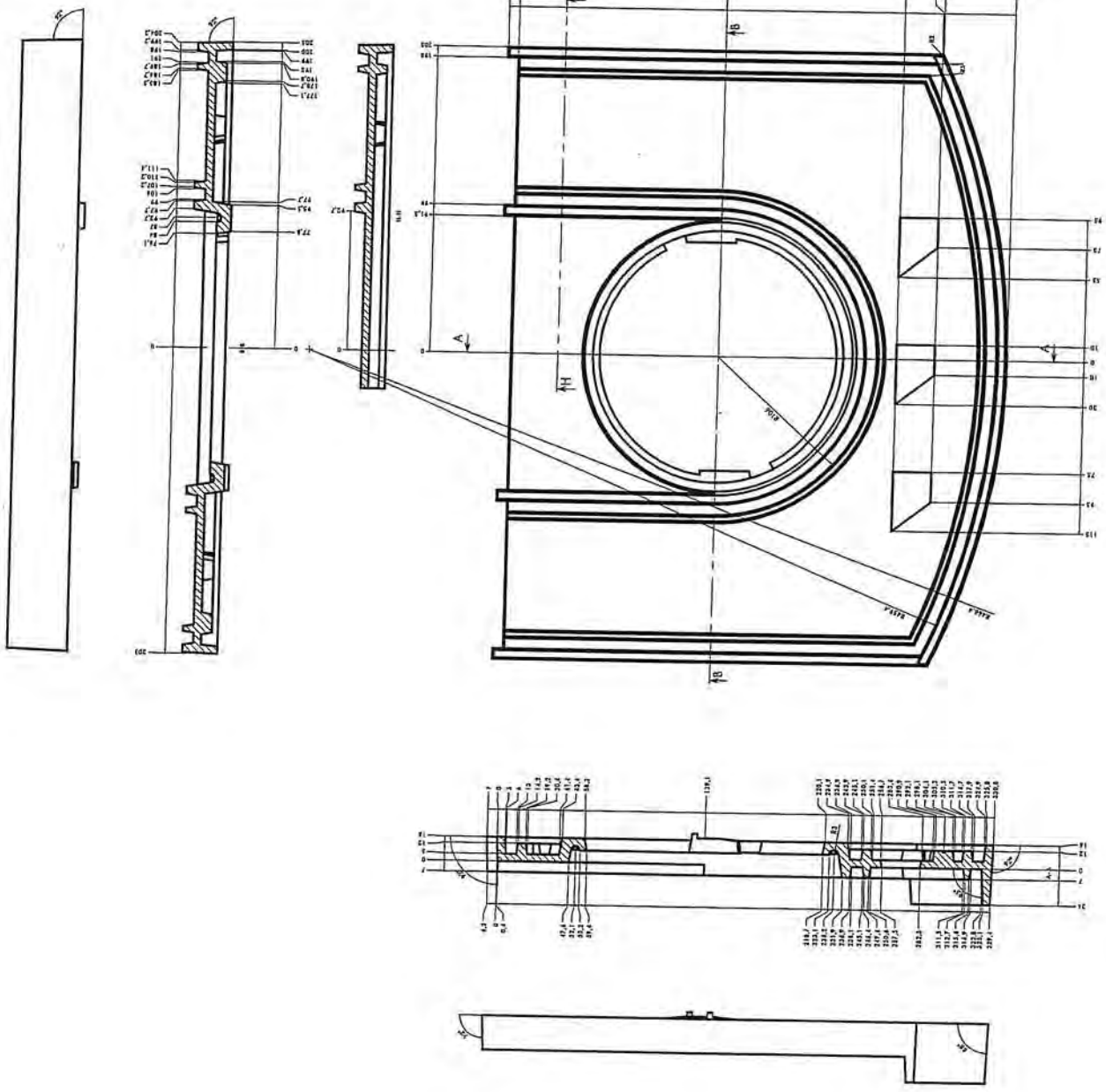


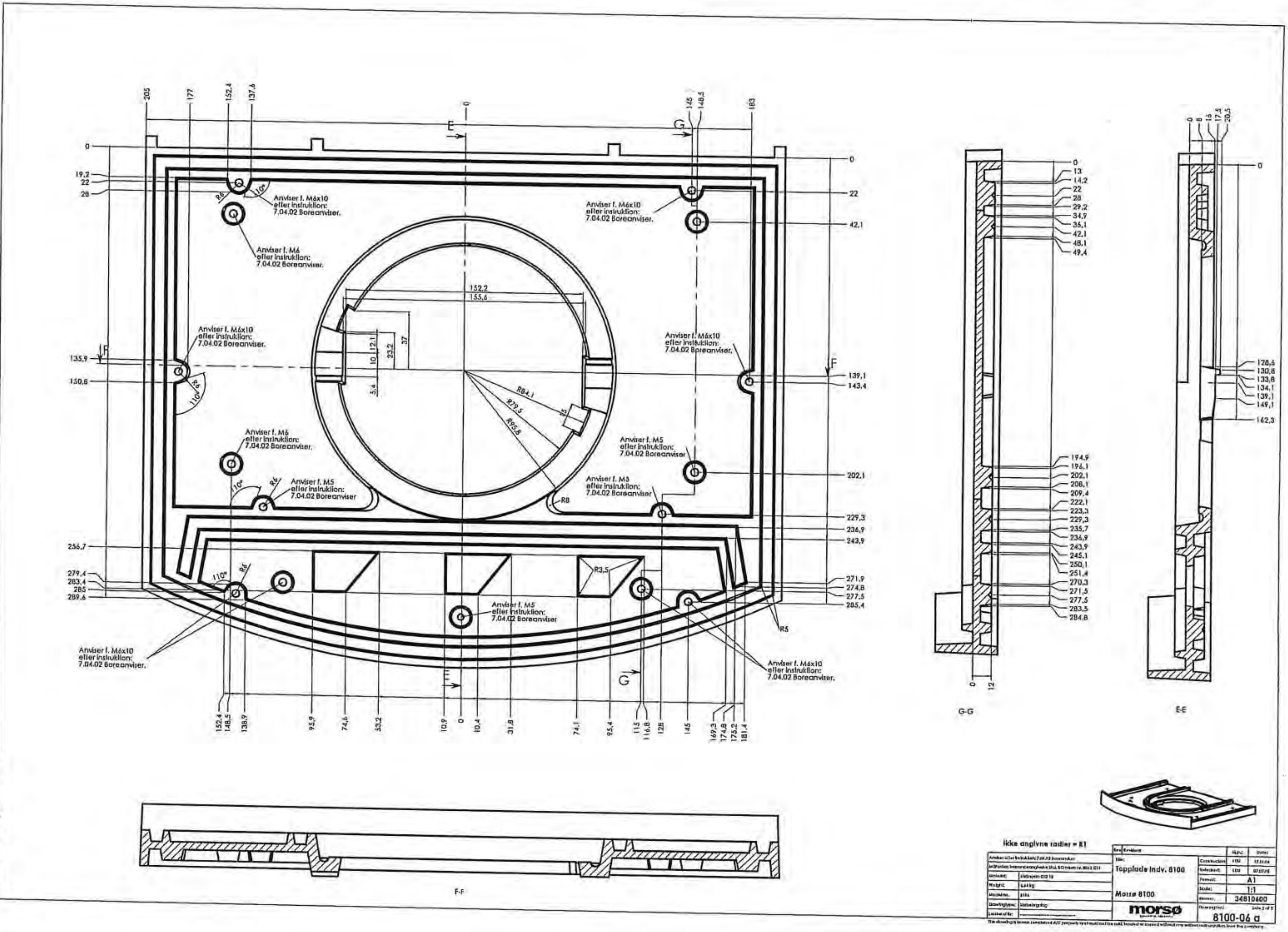




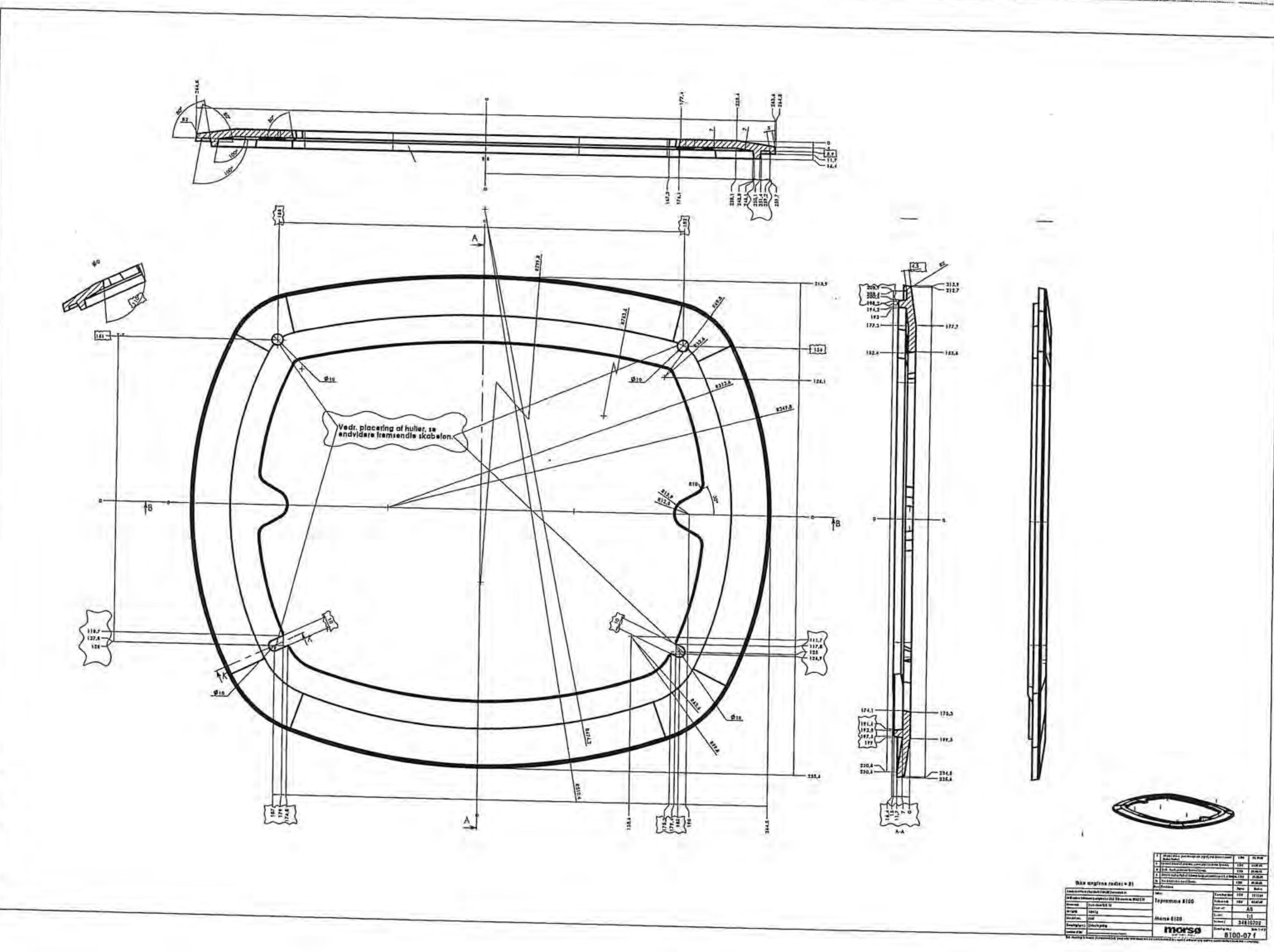


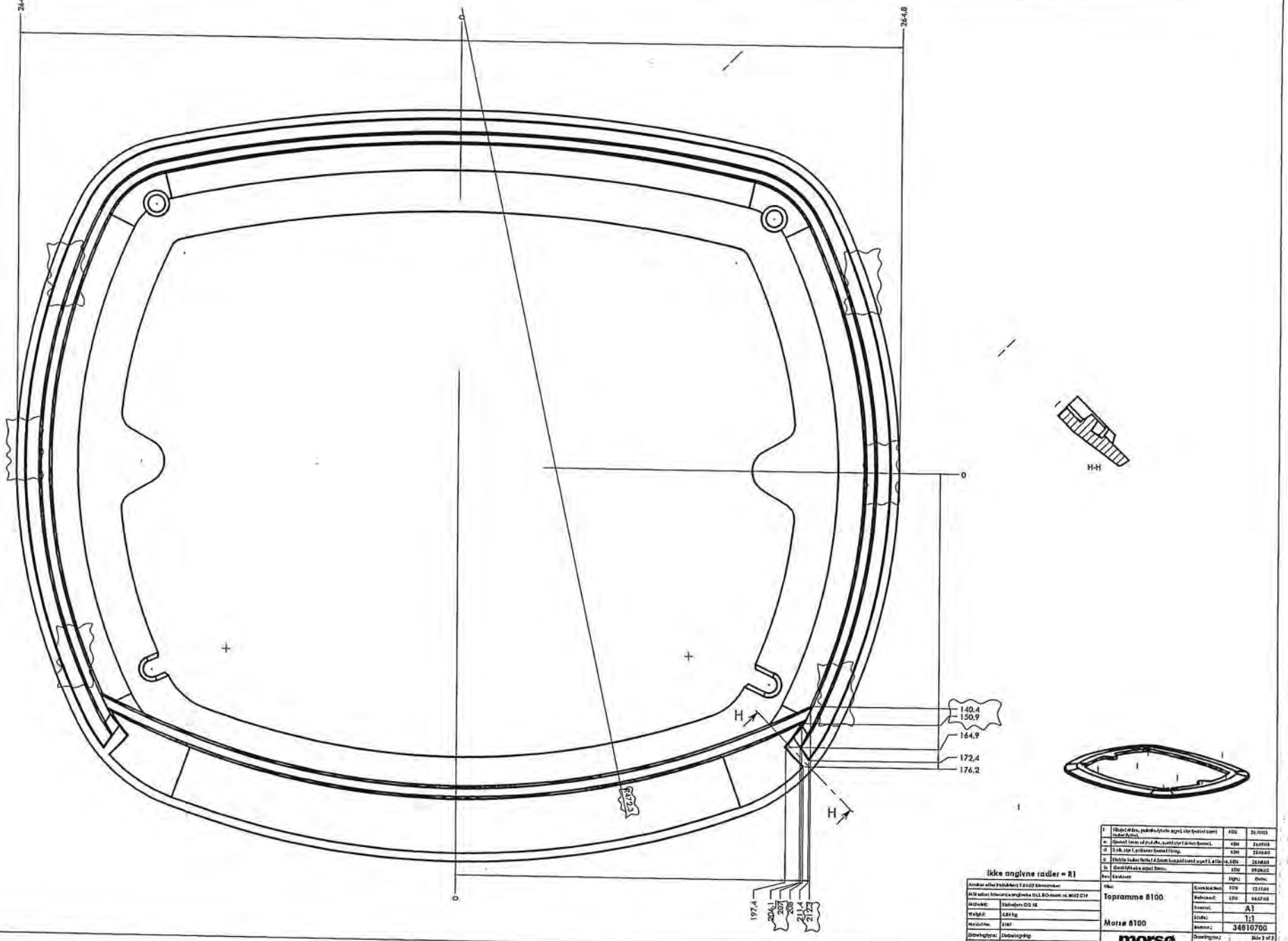





Anviser f. M6x10 efter instruktion: 7.04.02 Boreanviser.
Anviser f. M6 efter instruktion: 7.04.02 Boreanviser.
Anviser f. M5 efter instruktion: 7.04.02 Boreanviser
Anviser f. M3 efter instruktion: 7.04.02 Boreanviser
R84,1
R79,5
R95,8
R8
R6
R5
R3,5
110°
152,2
155,6
E-E
G-G
F-F
Ikke angivne radier = R1
Topplade indv. 8100
Morsø 8100
morsø
A1
1:1
34810600
8100-06 a

3-22 of 3-103


Vedr. placering af huller, se endvidere fremsendte skabelon.
Topramme 8100
Morsø 8100
morsø
A3
1:1
8100-07 f


264,8
264,8
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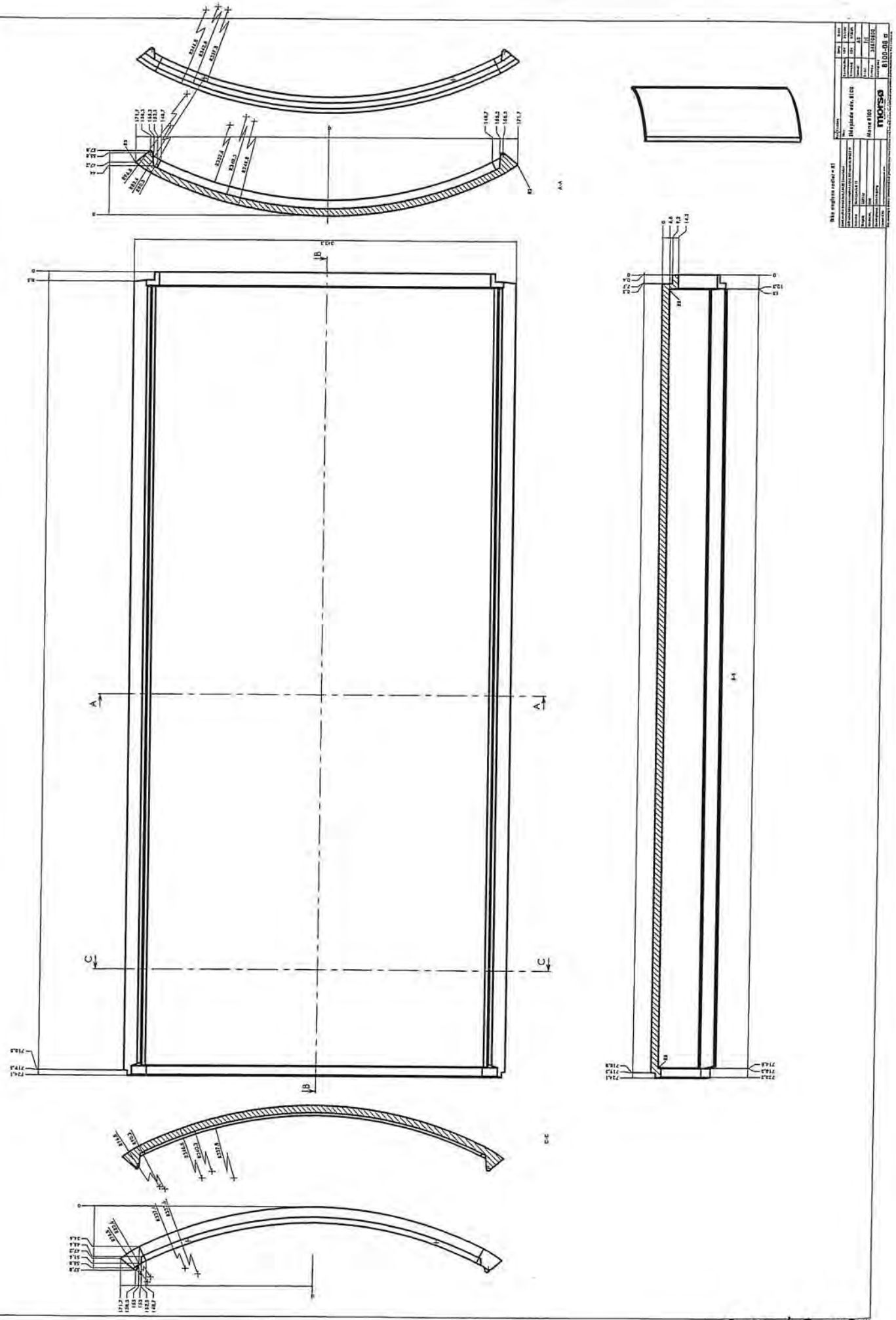
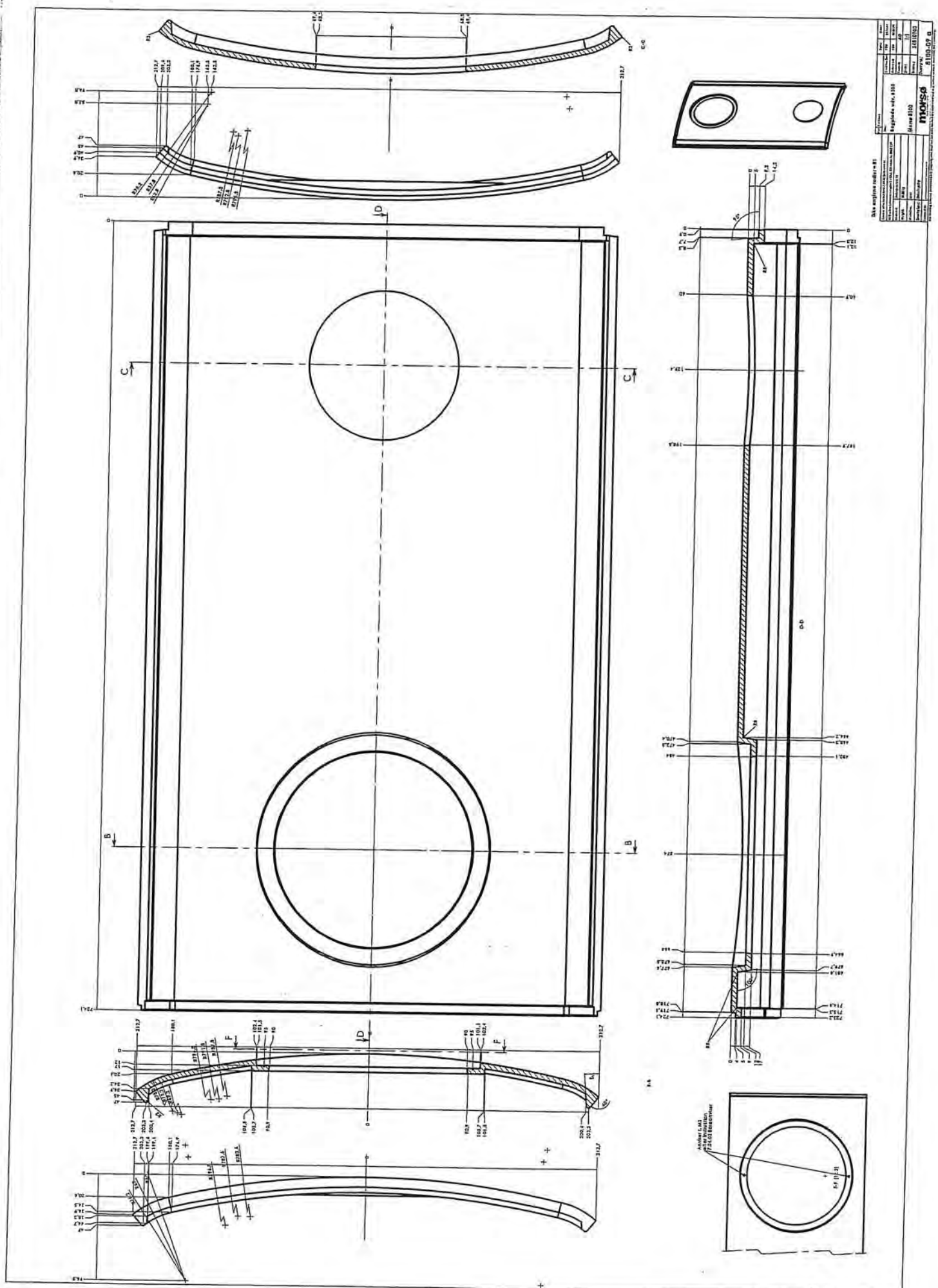
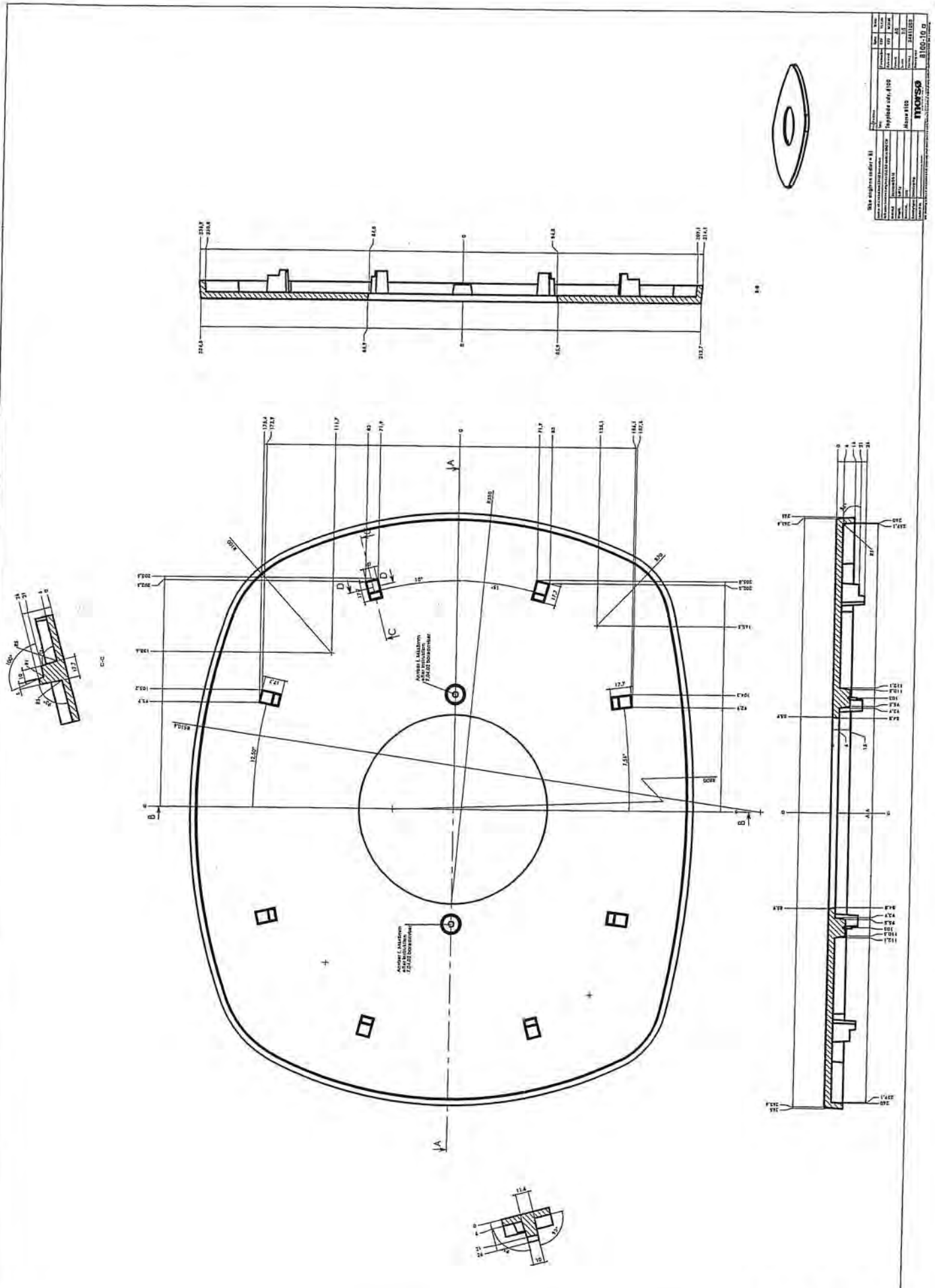
0
H-H
H
H
140,4
150,9
164,9
172,4
176,2
197,4
204,1
208
211,4
212
Ø172,5
Ikke angivne radier = R1
Topramme 8100
Morsø 8100
morsø
8100-07 f

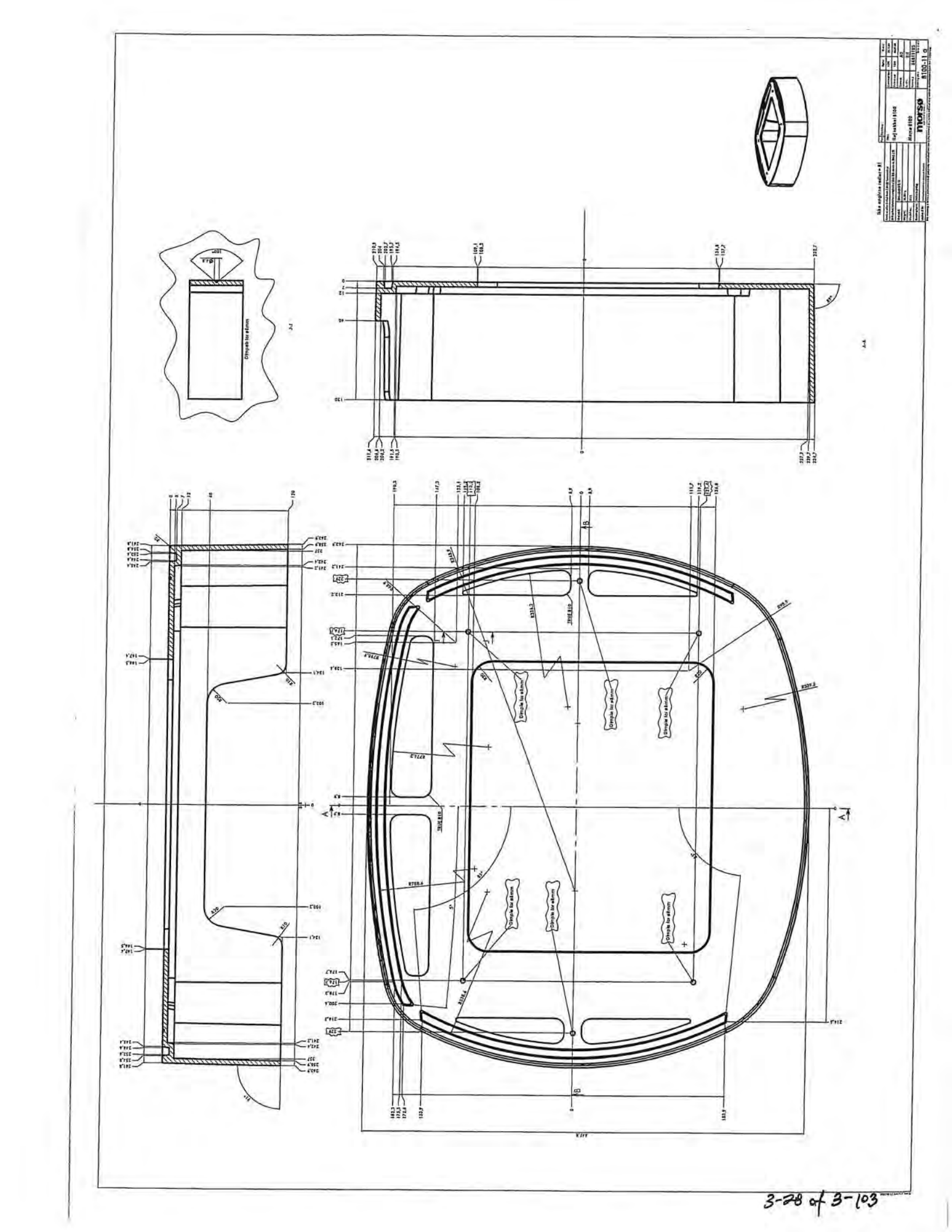
3-4 af 8-08

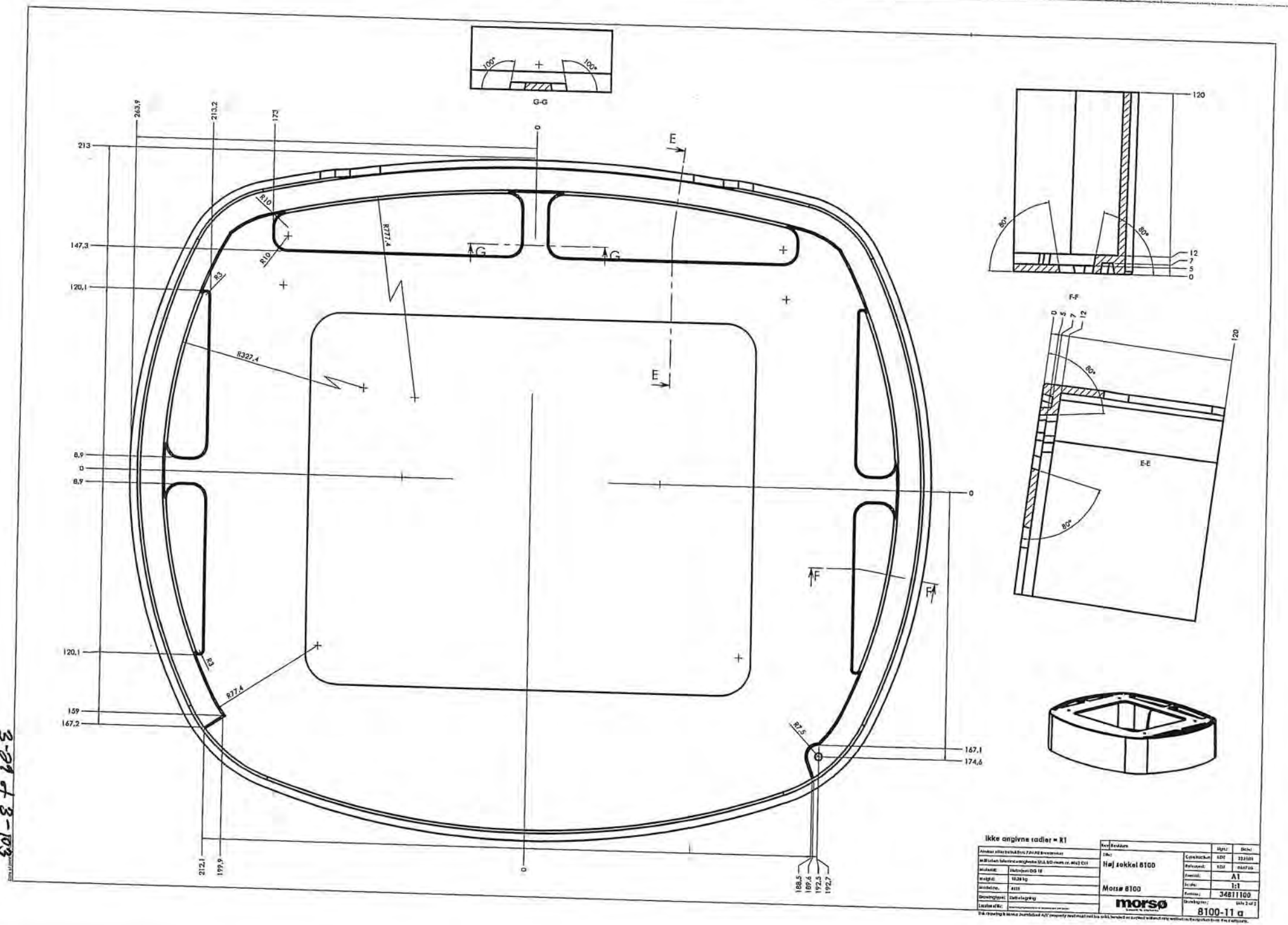


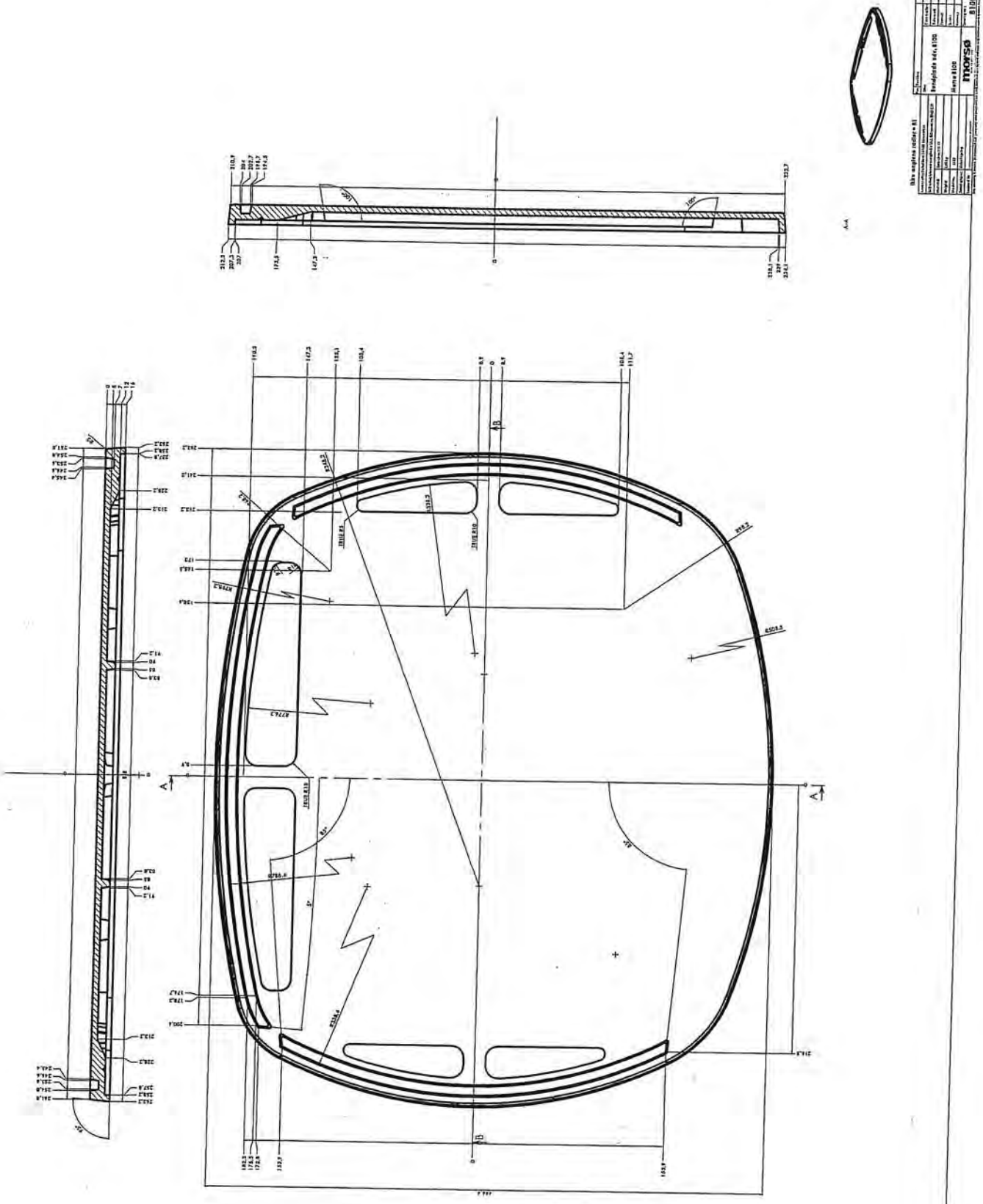




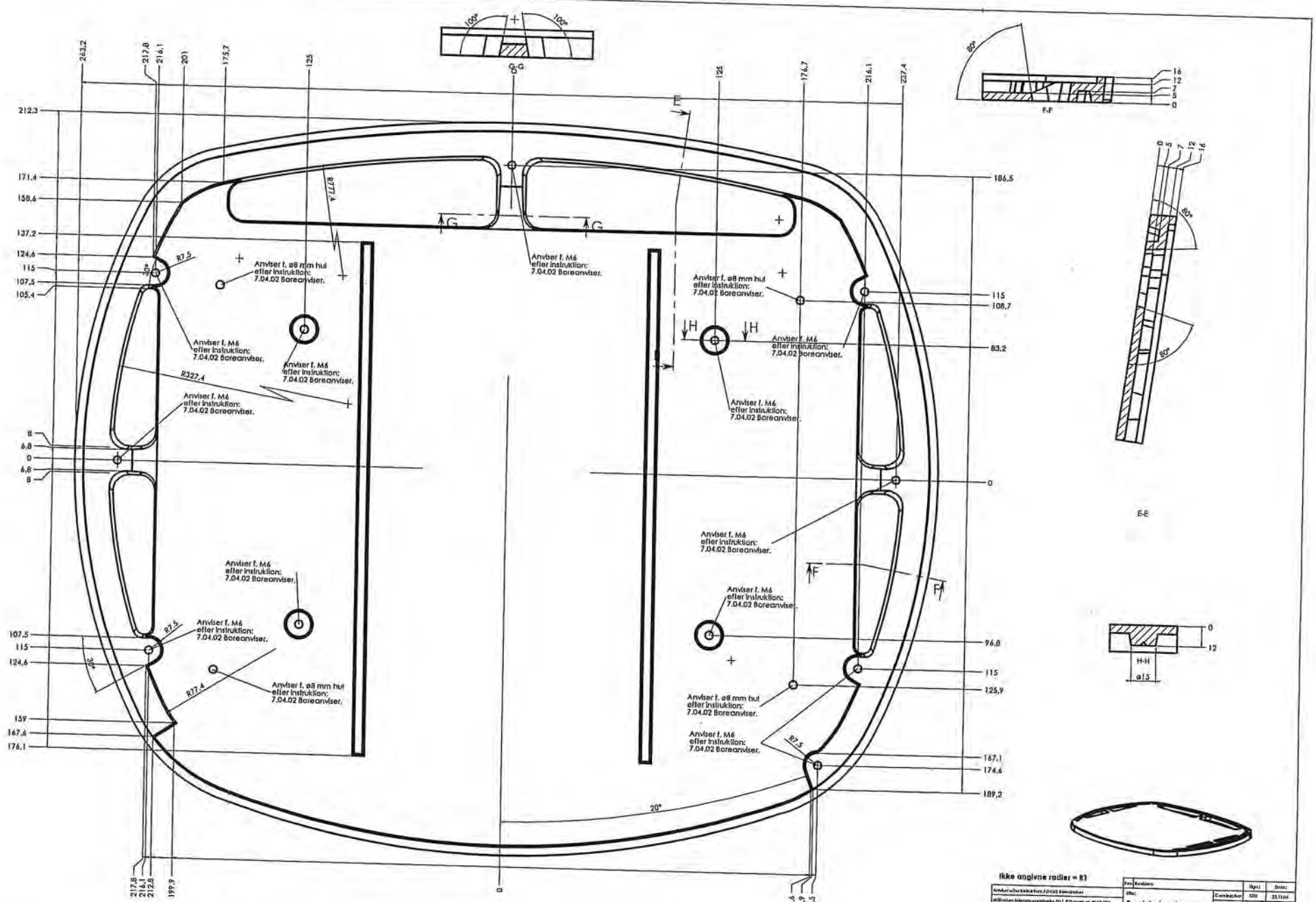
3-27 + 3-103

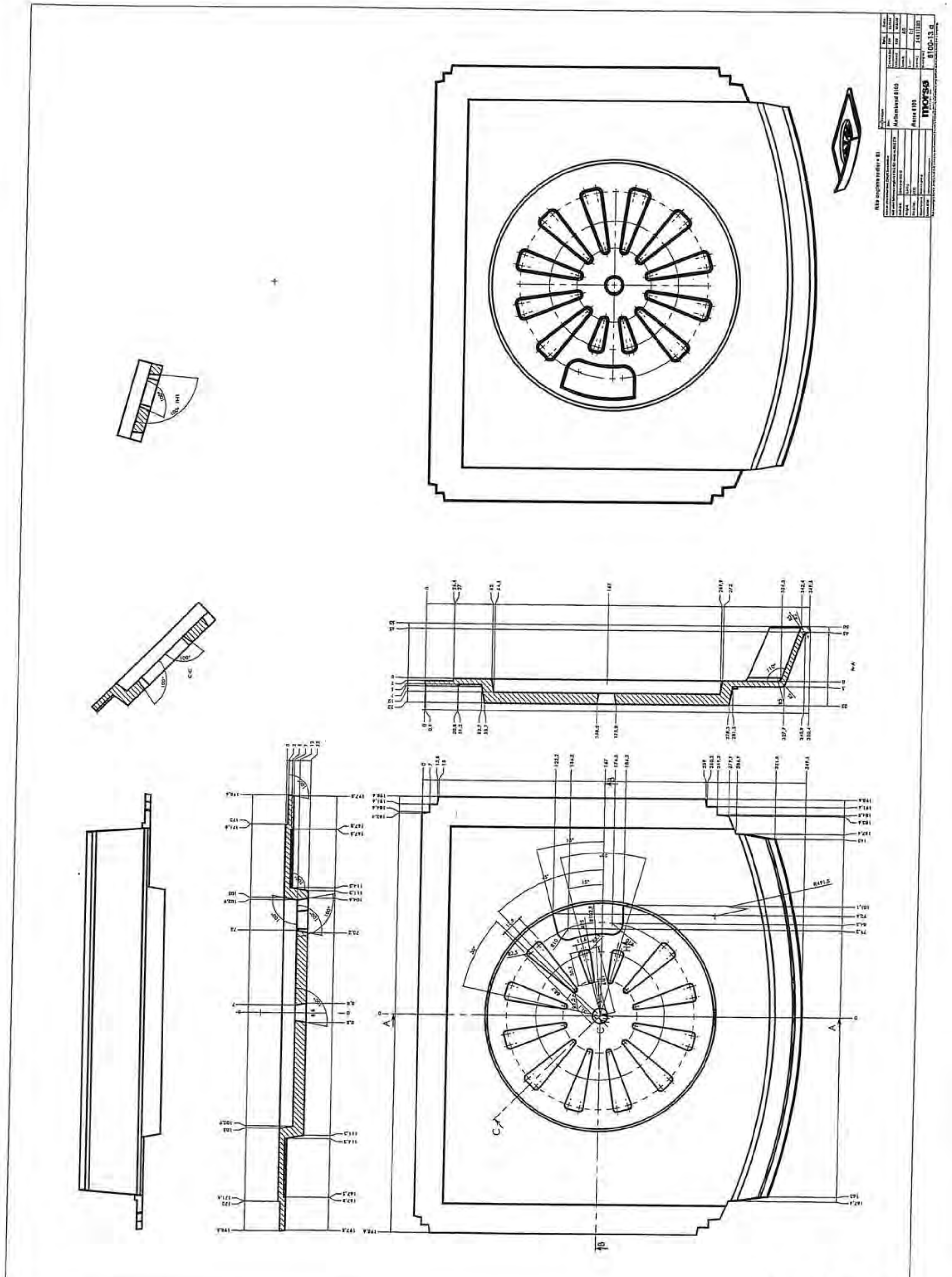

Dimple for 45mm
Dimple for 45mm
Dimple for 45mm
Dimple for 45mm
Dimple for 45mm
Dimple for 45mm

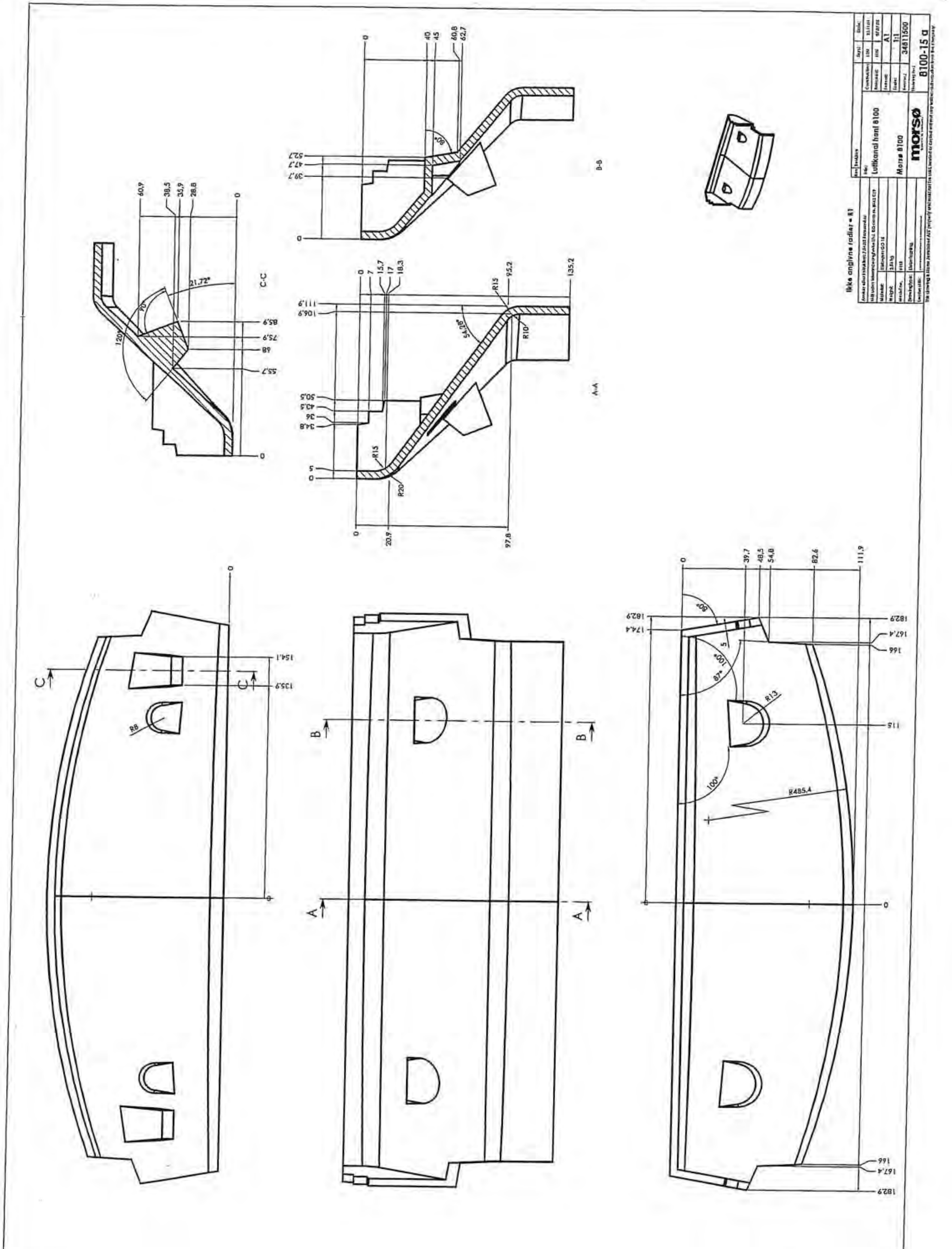

G-G
F-F
E-E
263,9
213,2
173
213
147,3
120,1
8,9
0
8,9
120,1
159
167,2
212,1
199,9
R10
R10
R3
R3
R327,4
R77,4
R77,4
R7,5
167,1
174,6
188,5
189,6
192,5
192,7
120
12
7
5
0
80°
80°
80°
80°
Ikke angivne radier = R1
Høj sokkel 8100
Morsø 8100
morsø
8100-11 a
A1
1:1
34811100

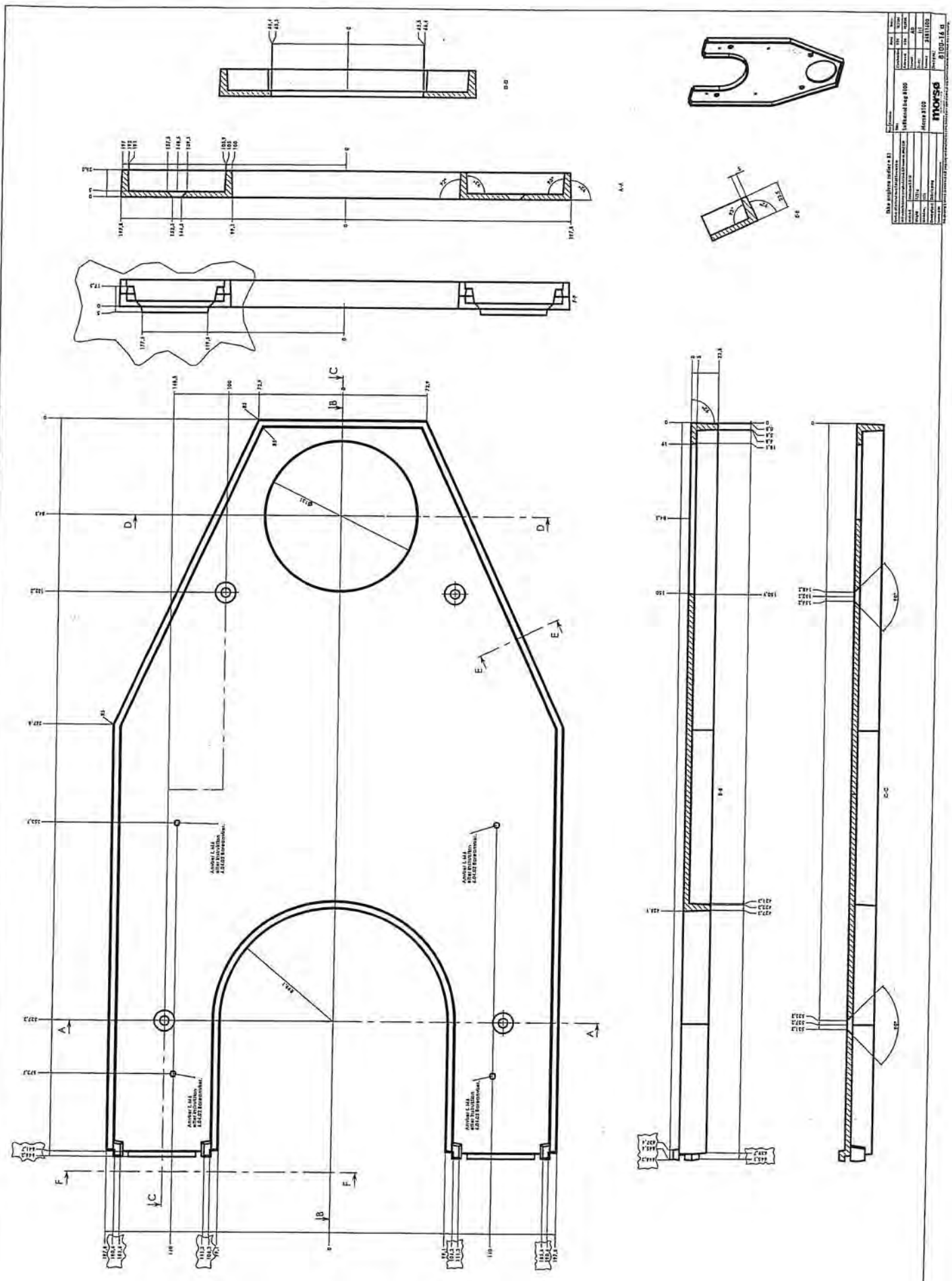


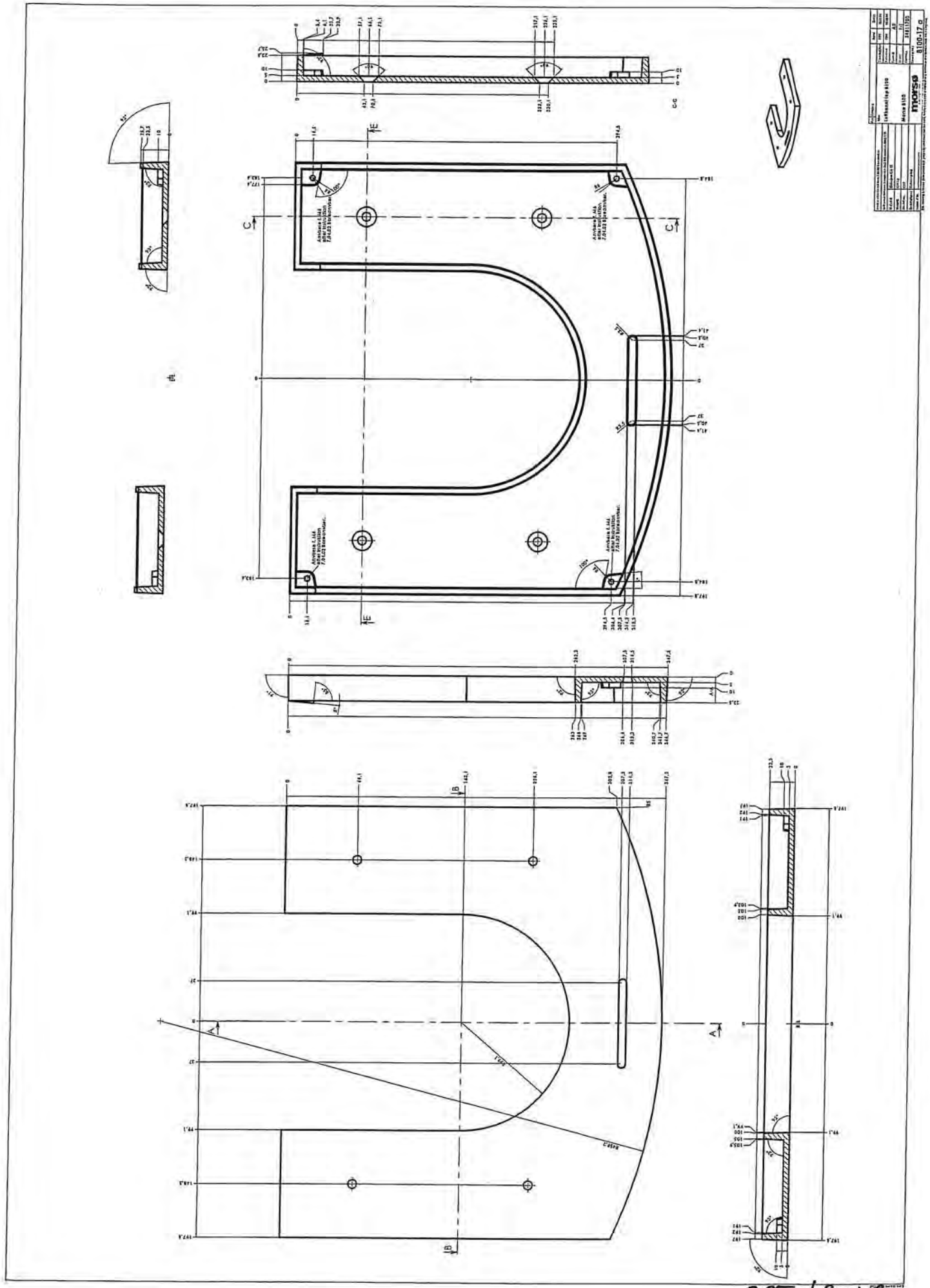
3-30 + 3-103

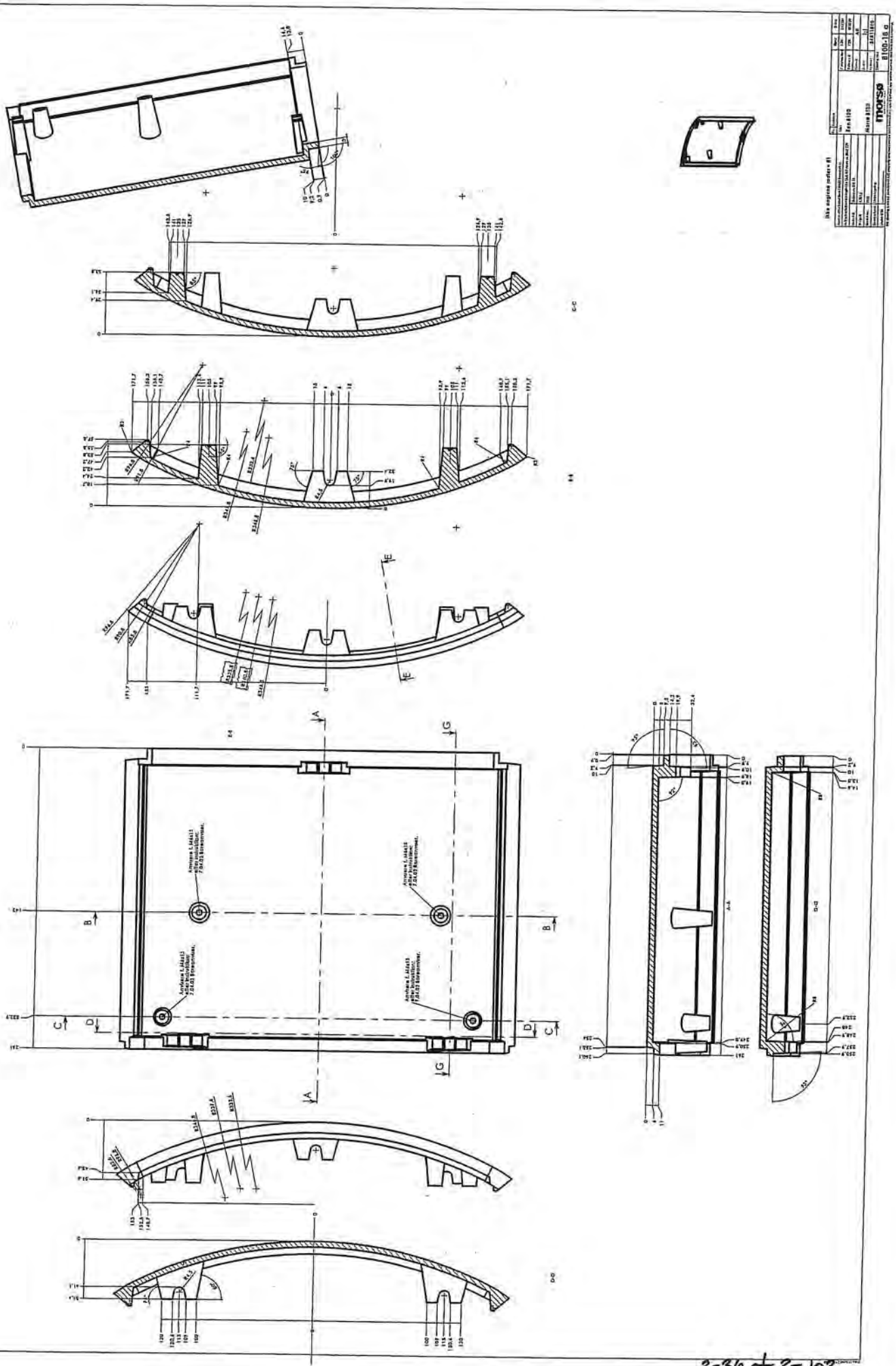

G-G
F-F
E-E
H-H
ø15
Anviser f. ø8 mm hul efter instruktion: 7.04.02 Boreanviser.
Anviser f. M6 efter instruktion: 7.04.02 Boreanviser.
R327,4
R77,4
R87,5
20°
30°
60°
263,2
217,8
216,1
201
175,7
125
212,3
171,4
158,6
137,2
124,6
115
107,5
105,4
186,5
108,7
83,2
0
96,8
125,9
174,6
189,2
167,1
176,1
167,6
159
199,9
212,8
188,6
189,9
192,5
237,4
176,7
Ikke angivne radier = R1
Bundplade udv. B100
Morsø B100
A1
1:1
34811200
B100-12 a
morsø

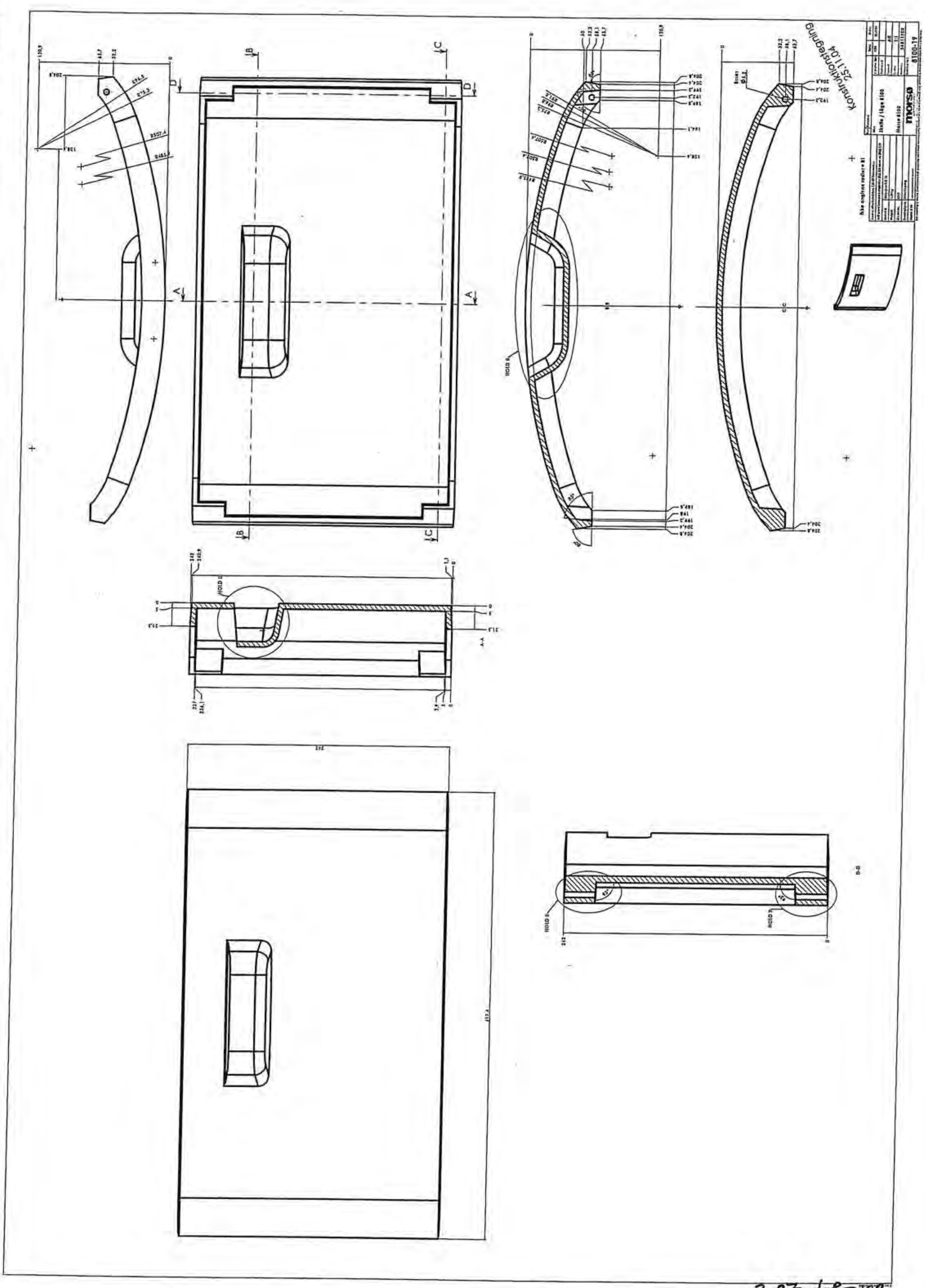

morsø
Morsø 8100
8100-13 a
A3
1:1
A-A
C-C

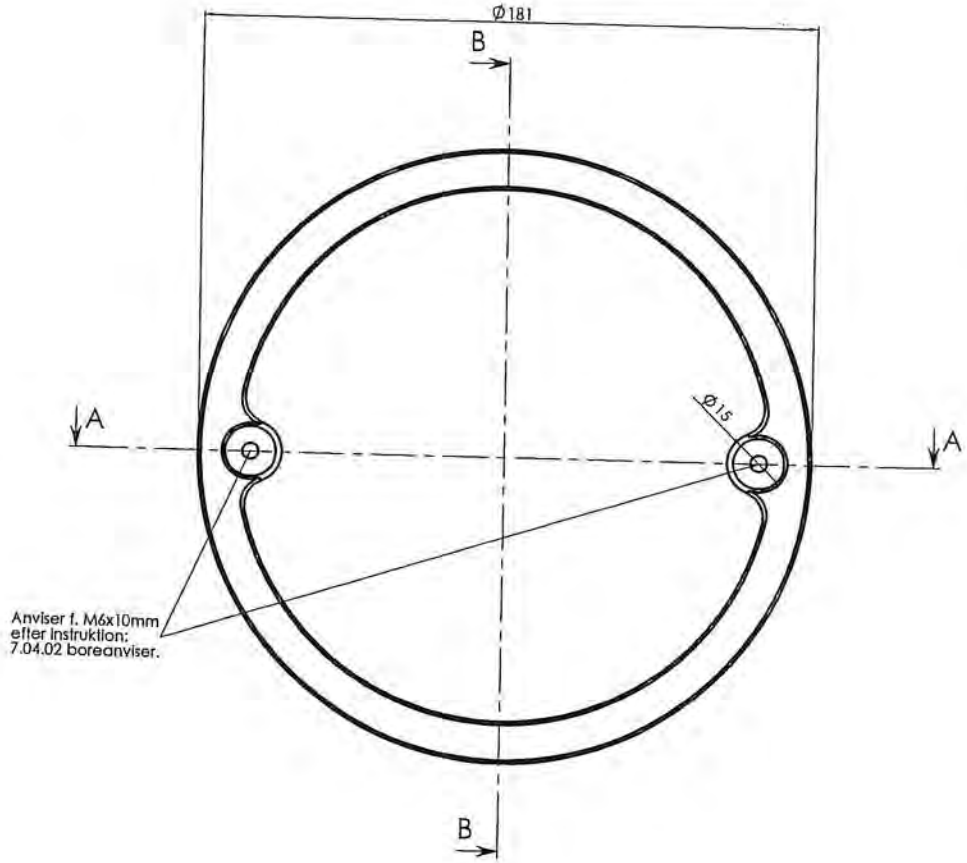

C-C
A-A
B-B
Ikke angivne radier = R1
Luftkanal front 8100
Morse 8100
morsø
3481500
8100-15 a

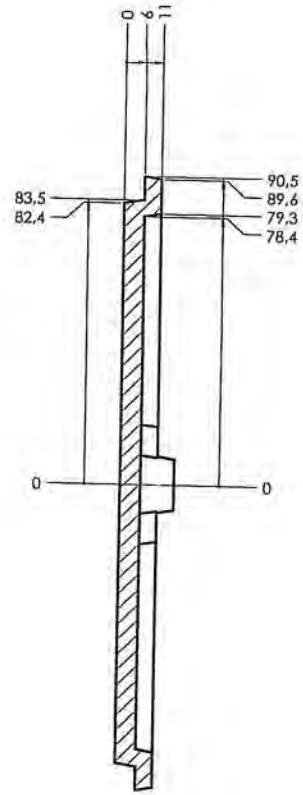




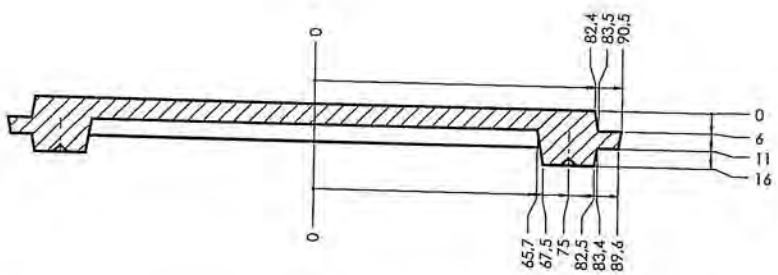



Konstruktionstegning
25.11.04
morsø
8100-19





B-B



Ikke angivne radier = R1

		Rev.	Revidere		Sign.:	Dato:
Anviser efter instruktion: 7.04.02 Boreanviser		Title:	Dæksel 8100	Construction:	KDU	25.11.04
Mål uden toleranceangivelse i h.t. ISO-norm nr. 8062 CT9				Released:	KDU	07.07.05
Material:	Støbejern GG 15			Format:	A2	
Weight:	1,19 kg		Morsø 8100	Scale:	1:1	
Model no.	8120			Itemno.:	34812000	
Drawingtype:	Støbelegning		morsø	Drawing no.:	8100-20 a	
Location of file:						

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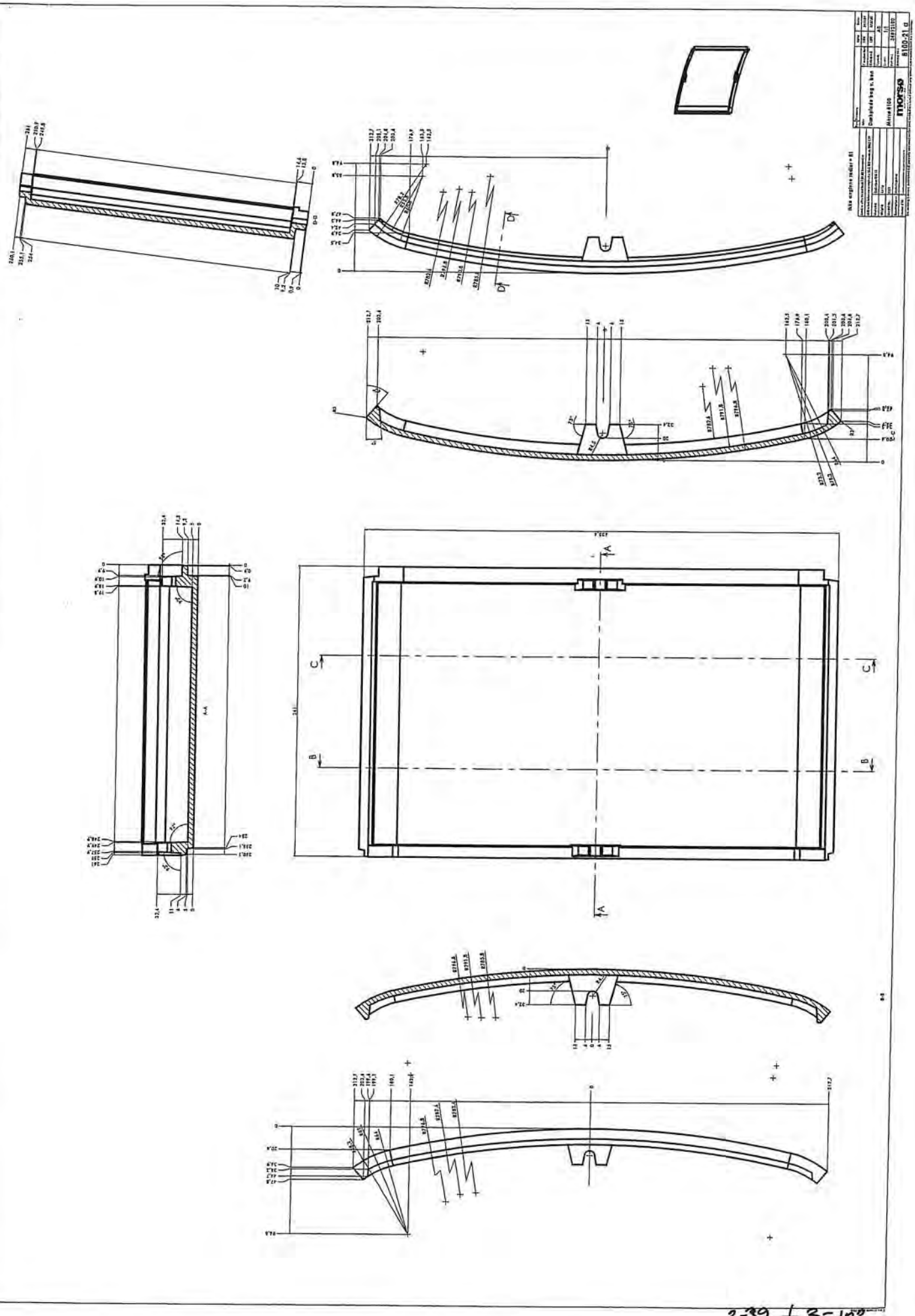
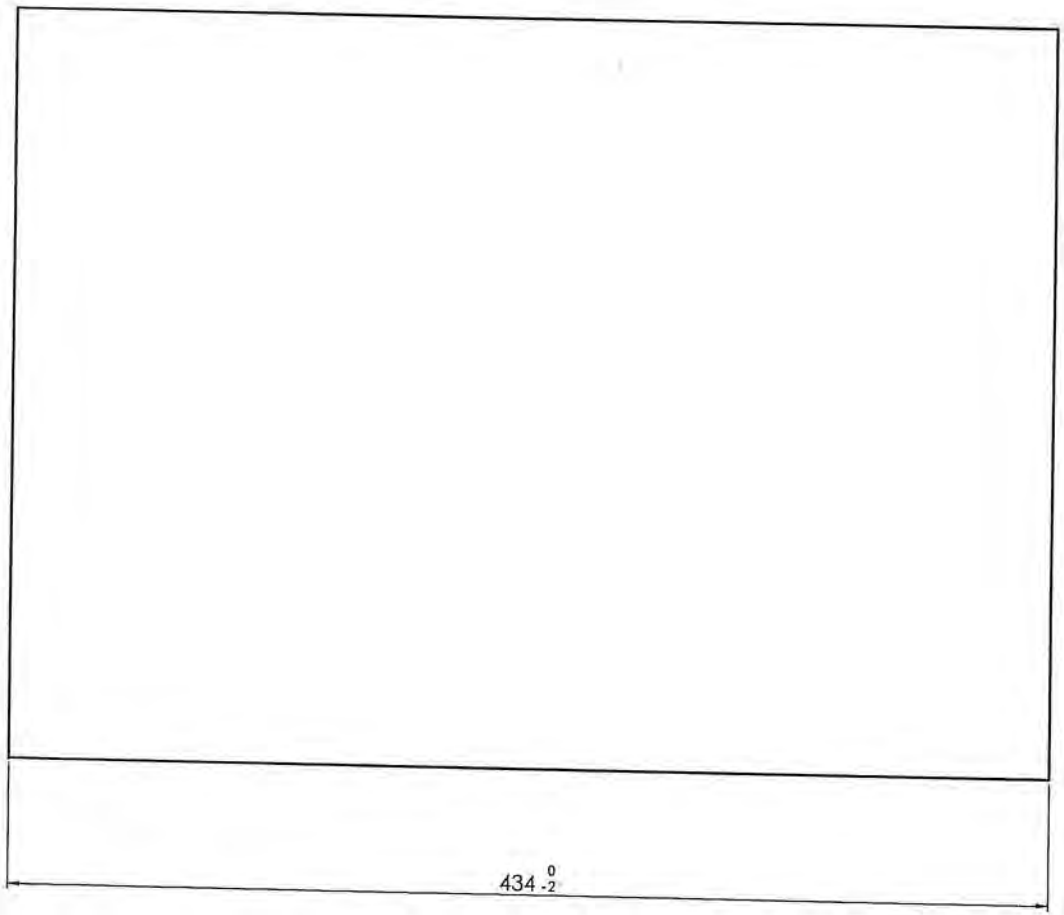
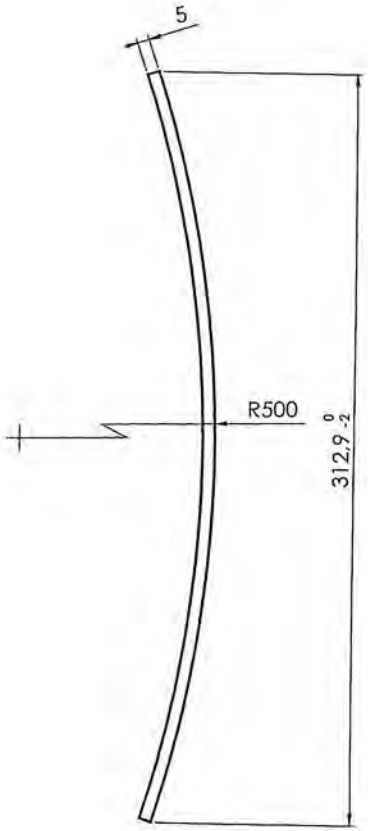


3-39 + 3-103





Rev.	Revisions	Sign.:	Date:

See Drawing	
Material:	Keramisk glas
Weight:	1,72 kg
Model no.	-
Drawingtype:	Emnetegning
Location of file:	

Title: **Glas 8100**

Morsø 8100

Construction:	KDU	29.09.04
Released:	KDU	08.04.05
Format:	A3	
Scale:	1:2	
Itemno.:	79810100	
Drawing no.:	8100-24 a	

morsø

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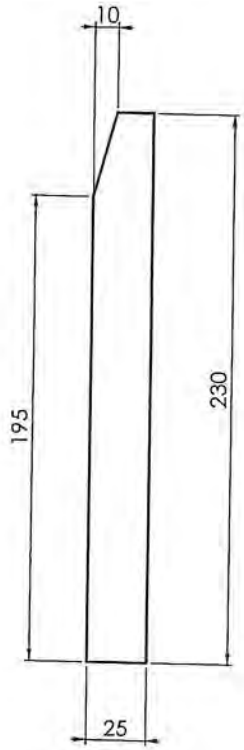
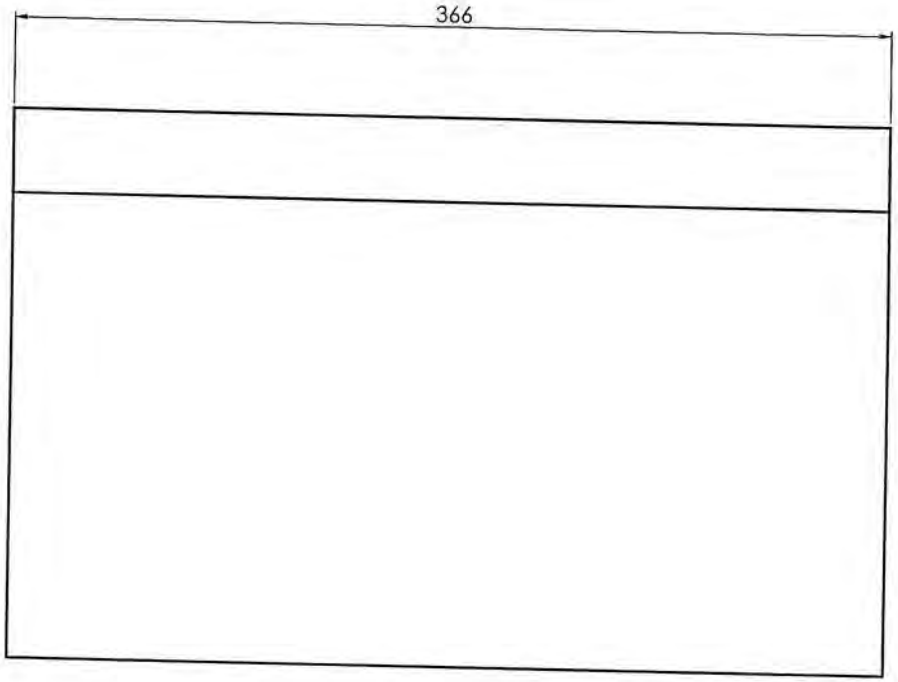
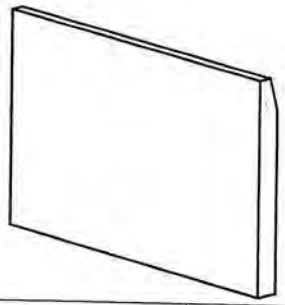
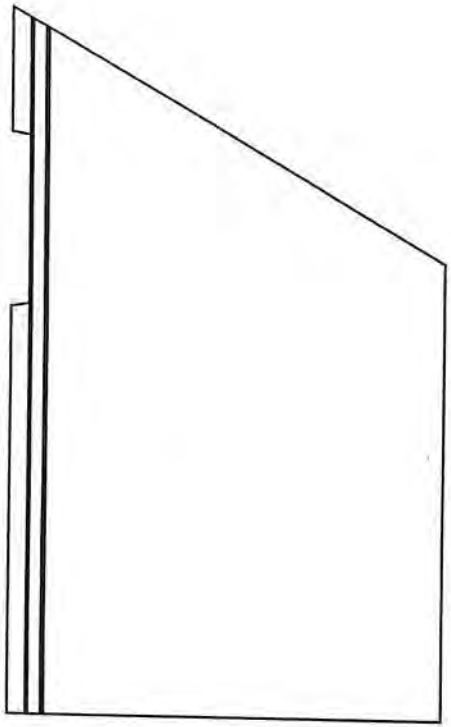


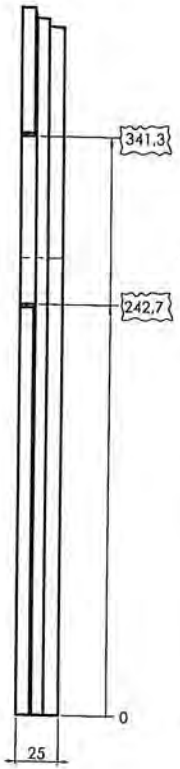


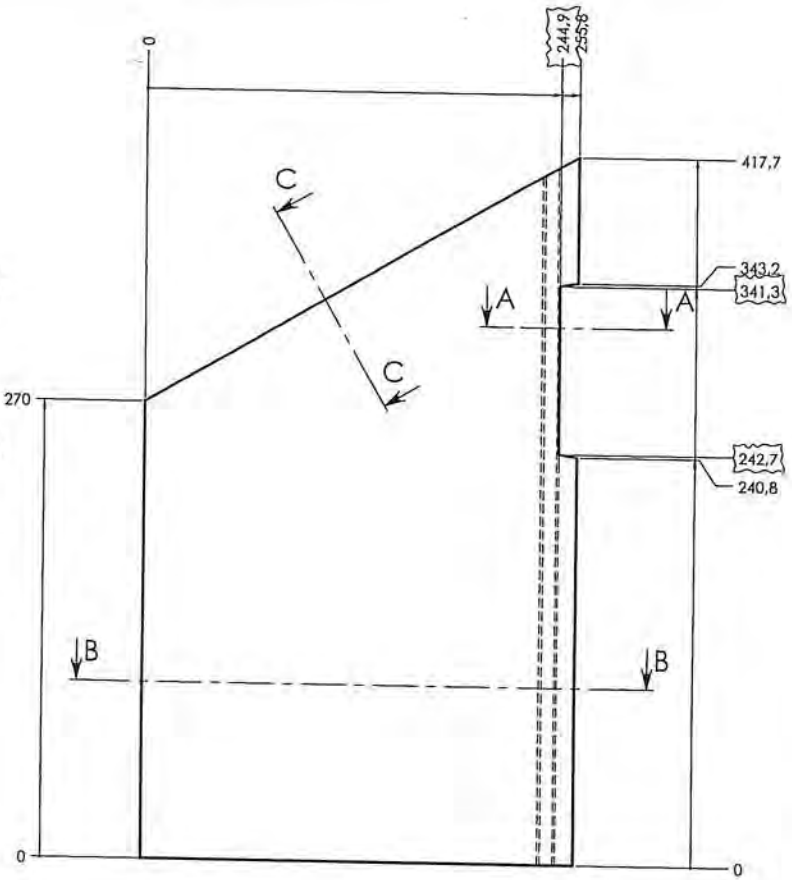


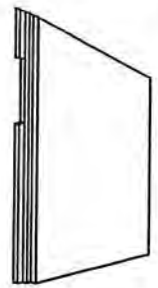
		Rev.	Revisions	Sign.:	Date:
			Title: Sten bag	Construction: KDU	25.01.05
Generel tolerance: +1mm, -2mm.				Released: KDU	04.07.05
Material:	Vermiculite v-1100 Mk.2			Format:	A3
Weight:	1,22 kg			Scale:	1:2
Model no.	-		Morsø 8100	Itemno.:	79810200
Drawingtype:	Emnetegning		morsø	Drawing no.:	8100-26 a
Location of file:					

Date of Scanning 3-11

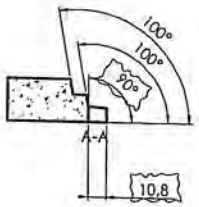


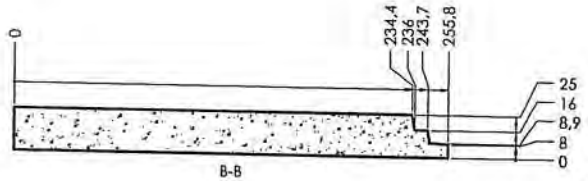






C-C





B-B

e	Tilpasset leverandørs krav.	KDU	12 .09.05
d	Tilpasset leverandørs krav.	KDU	12 .09.05
c	Tilpasset leverandørs krav.	KDU	07.09.05
b	Taget af slenen ved indhakket.	KDU	01.09.05
Rev.	Revisions	Sign.:	Date:

		Title:	Sten side - Højre
General tolerance: +1mm, -2mm.		Construction:	KDU 25.01.05
Material:	Vermiculite v-1100 Mk.2	Released:	KDU 04.07.05
Weight:	1,25 kg	Format:	A2
Model no.	-	Scale:	1:2
Drawingtype:	Emnetegning	Item no.:	79810300
Location of file:		Drawing no.:	8100-27 e

Morsø 8100

morsø

Date of print: 27-10-2005

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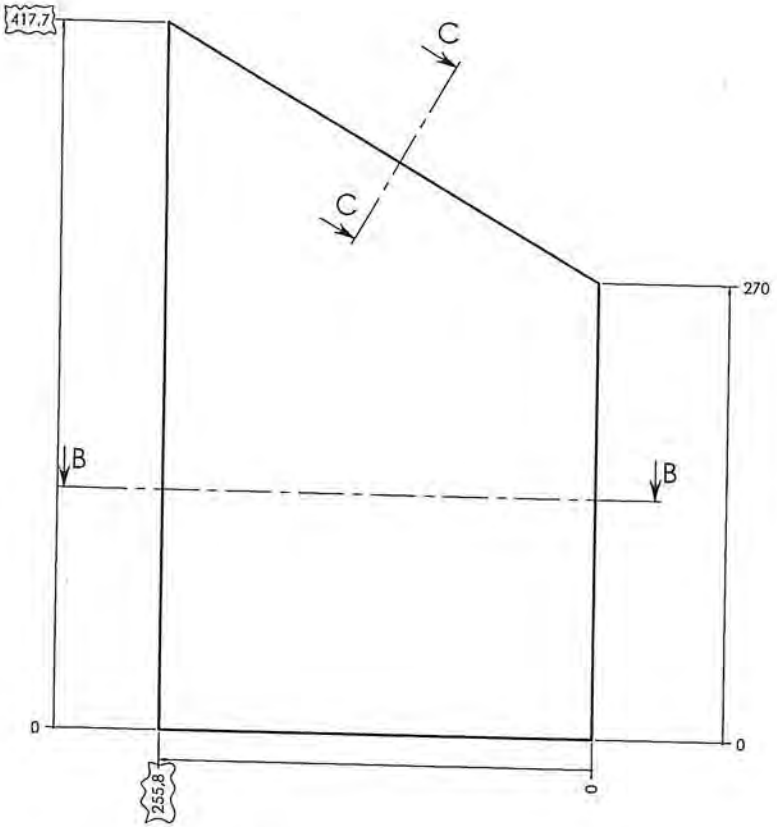
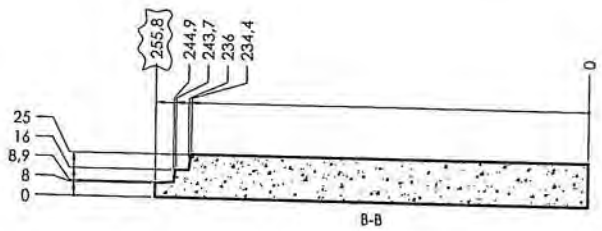
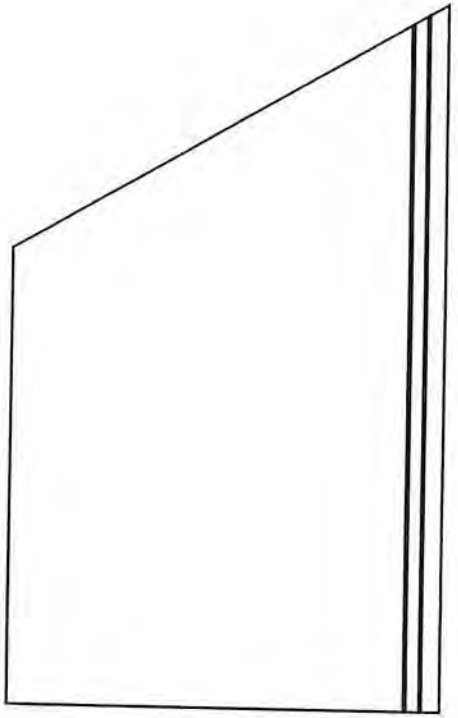
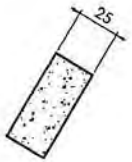


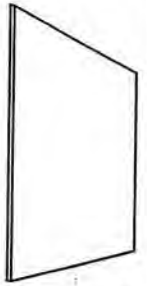


B-B





C-C

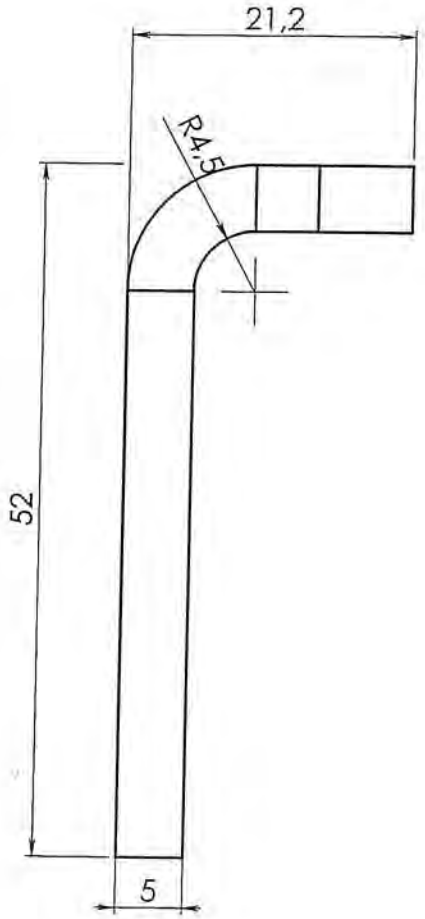


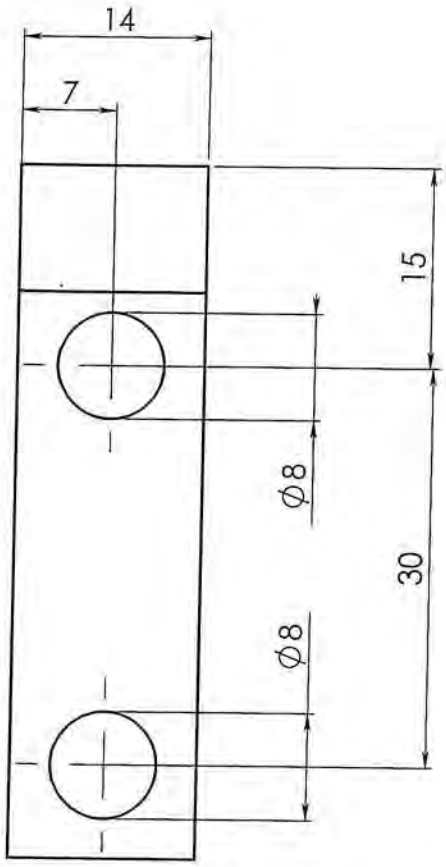
b	Tilpasset leverandørs krav.		KDU	07.09.05
Rev.	Revisions		Sign.:	Date:
	Title: Sten side - Venstre	Construction:	KDU	25.01.05
		Released:	KDU	04.07.05
		Format:	A2	
	Morsø 8100	Scale:	1:2	
		Itemno.:	79810400	
	morsø	Drawing no.:	8100-28 b	

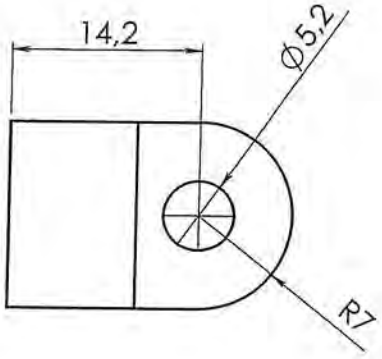
General tolerance: +1mm, -2mm.	
Material:	Vermiculite v-1100 Mk.2
Weight:	1,25 kg
Model no.	-
Drawingtype:	Emnetegning
Location of file:	[illegible]

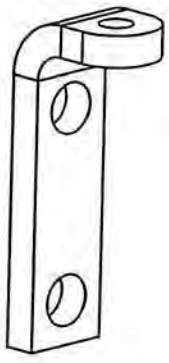
Date of print: 27-1

3 af 3-108



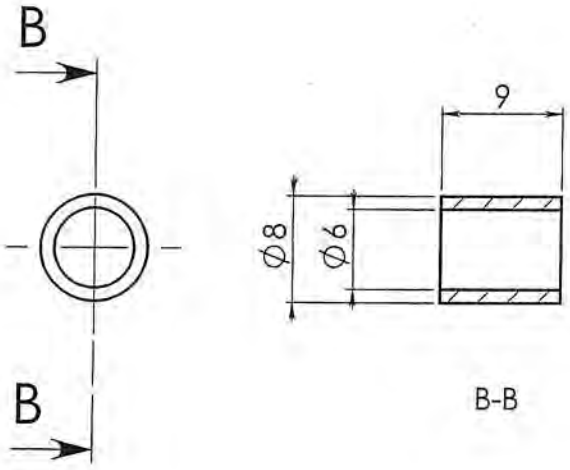






		Rev.	Revisions		Sign.:	Date:
		Title:		Construction:	KDU	13.01.05
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m		**Hængselsbeslag**		Released:	KDU	29.09.05
Material:	SPD Plade			Format:	A4	
Weight:	0,03 kg			Scale:	**2:1**	
Model no.	-	**Morsø 8100**		Itemno.:	**71810100**	
Drawingtype:	Emnetegning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

Date of print: 27-10-2005



Rev.	Revisions	Sign.:	Date:

Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m

Material:	Galv
Weight:	0, kg
Model no.	
Drawingtype:	Emnetegning
Location of file:	U:\UDV\tegninger\standardbibliotek\Afstandsrør\Afstandsrør ø8x1.SLDPRT

Title:

Afstandsstykke ø8x1 L=9mm

Hydraulikrør galv.

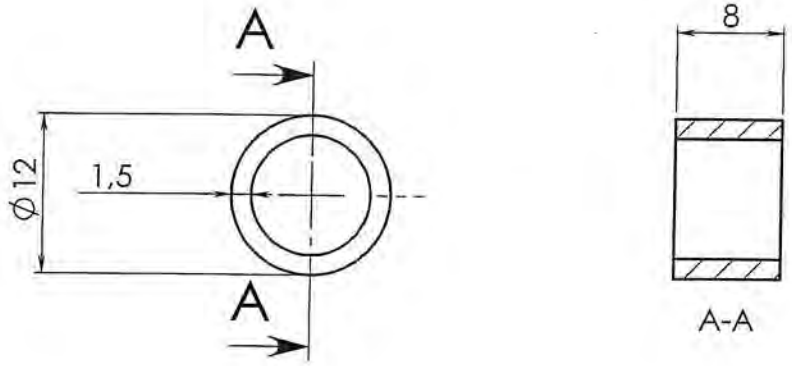
Morsø 3400

morsø

By appointment to the Royal Danish Court

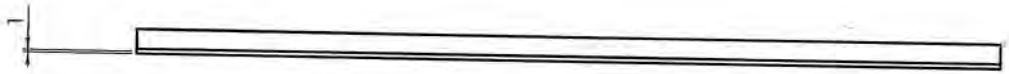
Construction:	KDU	18.01.05
Approved:	KDU	29.09.05
Format:	A4	
Scale:	2:1	
Itemno.:	71810200	
Drawing no.:	8100-31 a	

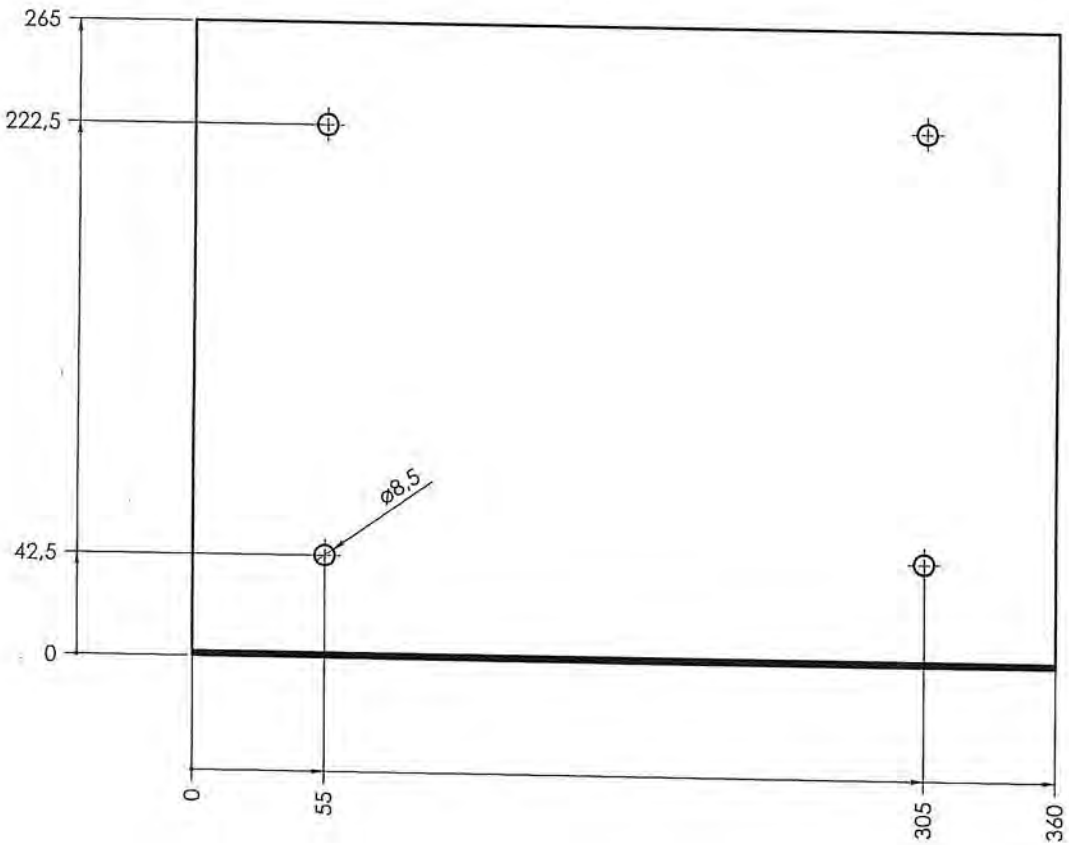
Date of print: 27-10-2005



		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\ulandsbibliotek\Afstandsrør\Afstandsrør ø12x1,5.IDW					

Date of print: 27-10-2005





		Rev.	Revisions		Sign.:	Date:
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m			Title:	Construction:	KDU	19.01.05
Material:	Galvaniseret plade		**Stråleplade bund**	Released:	KDU	29.09.05
Weight:	0,77 kg			Format:	A3	
Model no.	-			Scale:	1:2	
Drawingtype:	Emnetegning		**Morsø 8100**	Itemno.:	71810400	
Location of file:			morsø	Drawing no.:	8100-33 a	

Date of print: 27-10-2005

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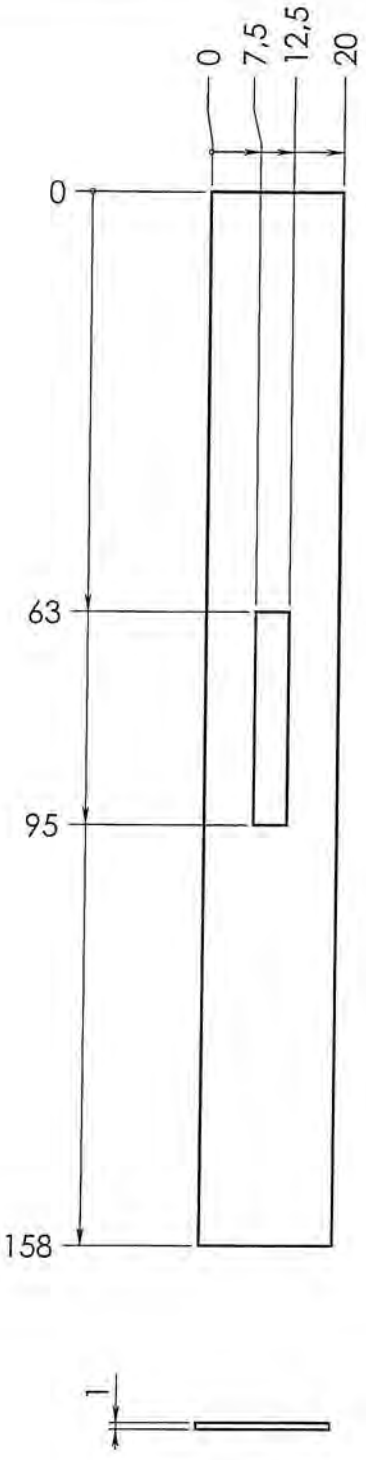
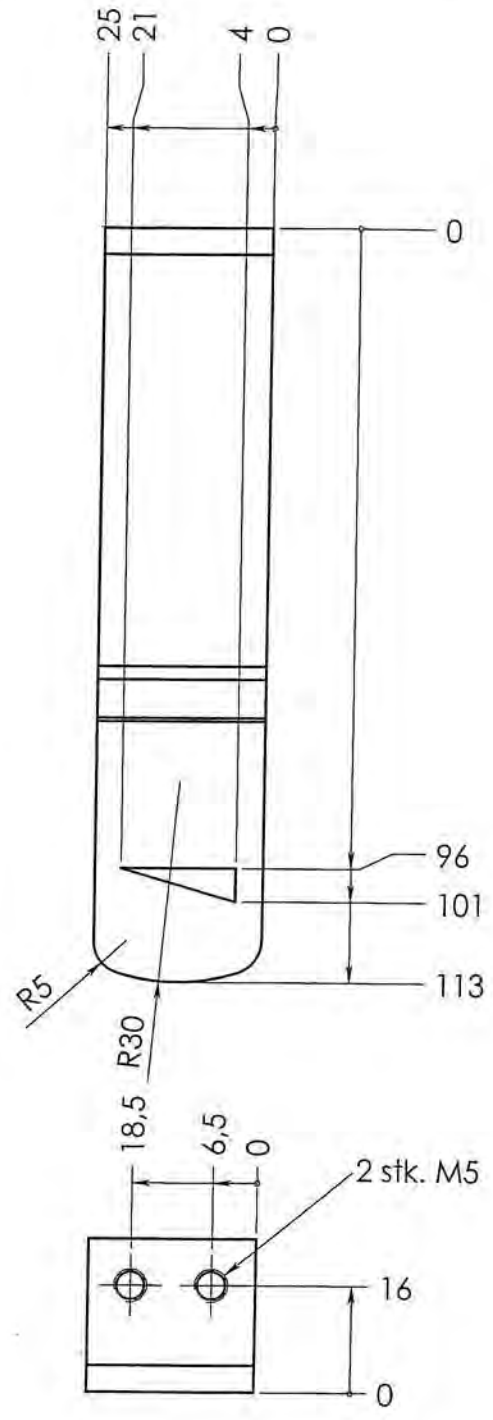
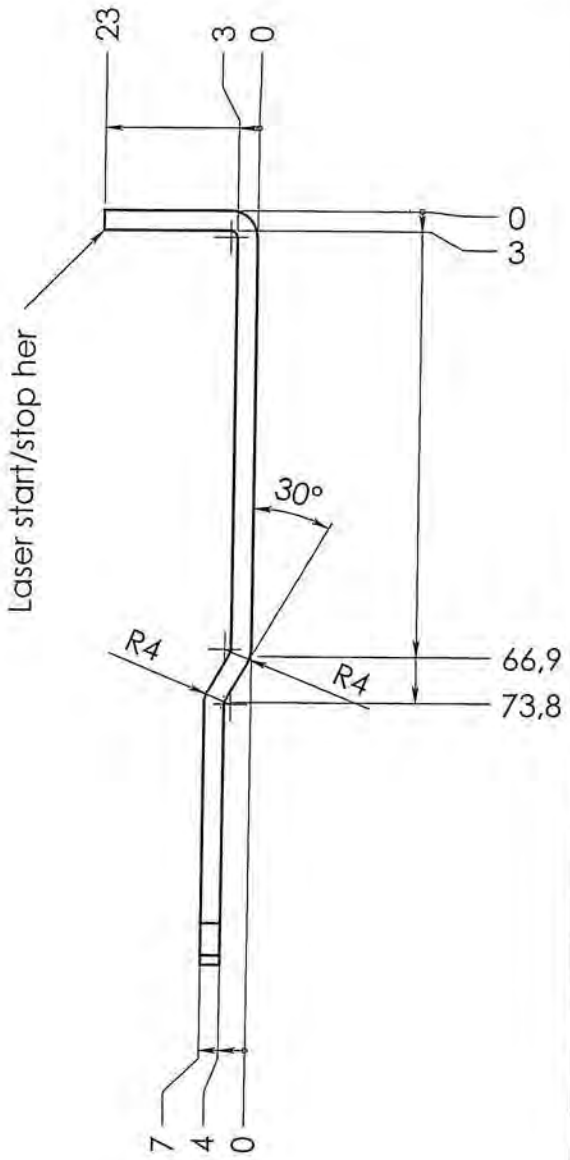


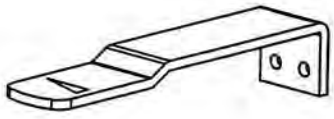
Rev.	Revisions	Sign.:	Date:

Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m		Title: **Lukkeplade for Sekundær spjæld Morsø 8100**	Construction:	KDU 18.01.05
Material:	SPD Plade		Released:	KDU 29.09.05
Weight:	0,02 kg		Format:	A4
Model no.	-		Scale:	1:1
Drawingtype:	Emnetegning		Itemno.:	71810600
Location of file:	U:\UDV\Tegninger\8100\8100-37 Lukkeplade sek. spjæld.SLDPRT	morsø By appointment to the Royal Danish Court	Drawing no.:	8100-37 a

Date of print: 27-10-2005

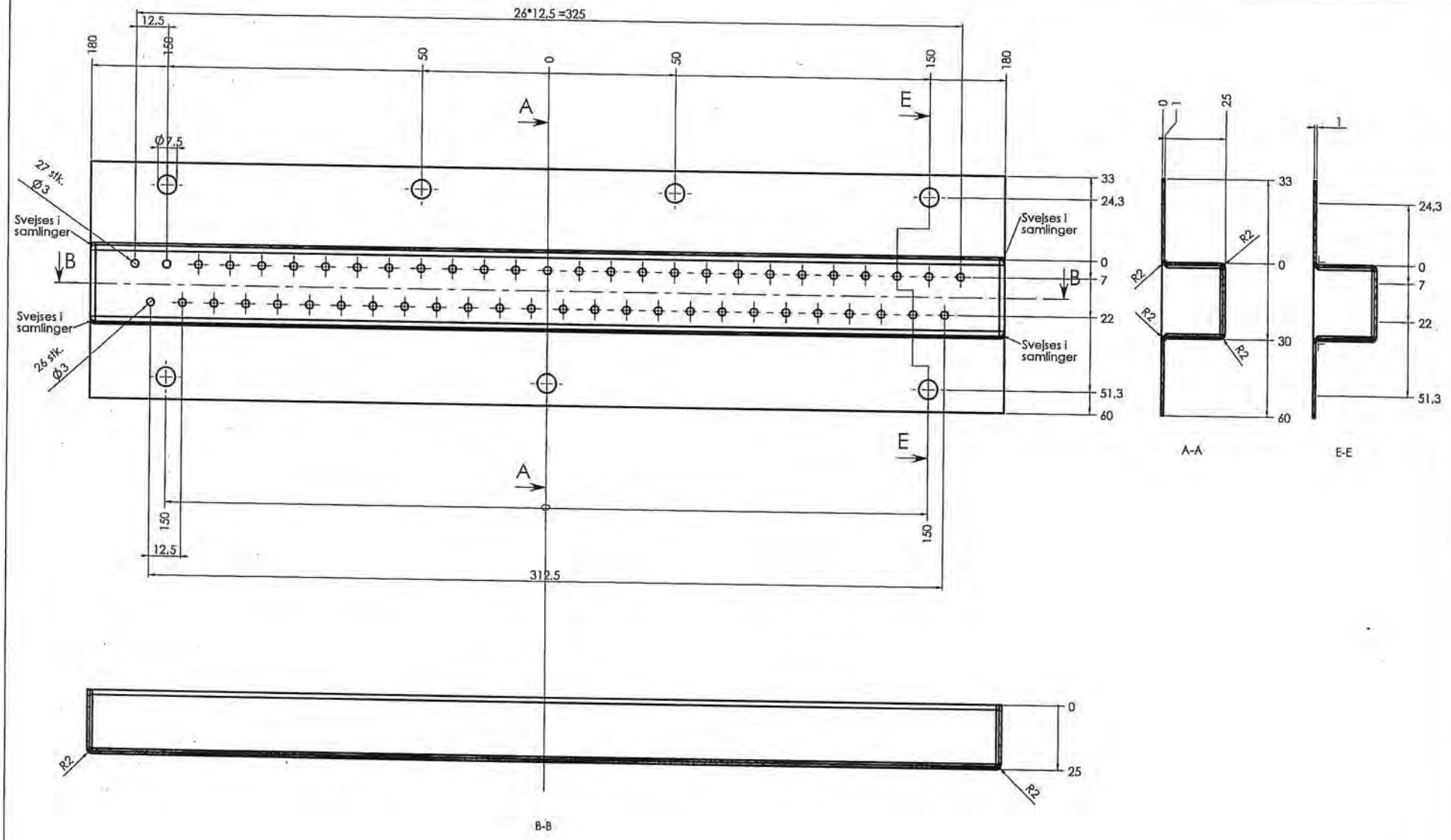






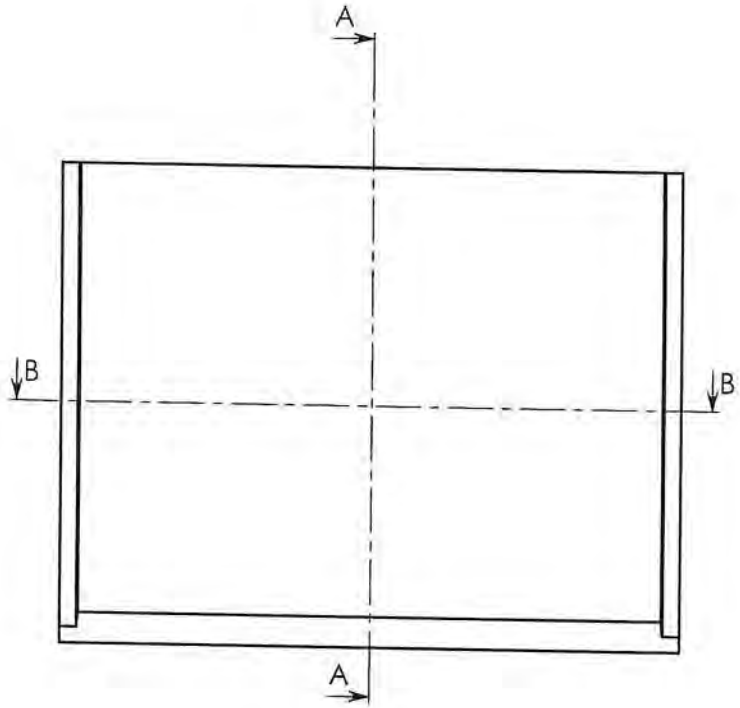
		Rev.	Revisions	Sign.:	Date:
Ingen grater på kanterne.		Title:	Construction:	KDU	21.12.04
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m		**Greb sek. spjæld**	Released:	KDU	29.09.05
Material:	Rustfri stål - Børstet		Format:	A4	
Weight:	0,08 kg		Scale:	1:1	
Model no.	-	**Morsø 8100**	Itemno.:	71810761	
Drawingtype:	Emnetegning	morsø By appointment to the Royal Danish Court	Drawing no.:	8100-38 a	
Location of file:	t:\UDV\tegninger\8100\8100-38 Greb sekundær spjæld.idrpf				

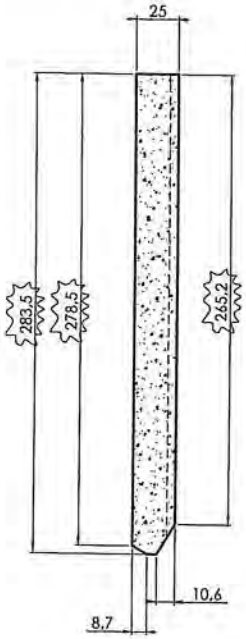
Date of print: 27-10-2005



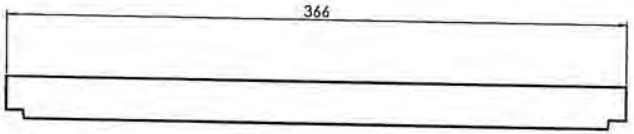
		Rev.	Revision		Sign.:	Date:
			Title:	Construction	KDU	18.08.05
Mål uden tolerance angivelse i h.t. DS/ISO 2768-1 m			Tertlær boks	Released:	KDU	29.09.05
Material:	Rustfri stål			Format:	A2	
Weight:	0.4 kg			Scale:	1:1	
Model no.	-		Morsø 8100	Item no.:	71810861	
Drawingtype:	Emnelægning		morsø	Drawing no.:	8100-41 a	
Location of file:						

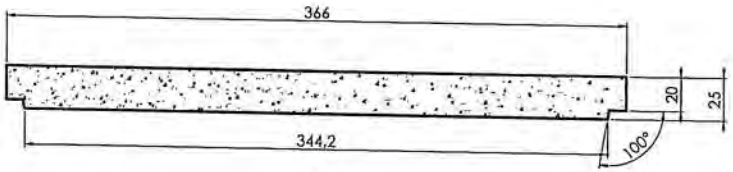
3-25 af 33-103





A-A





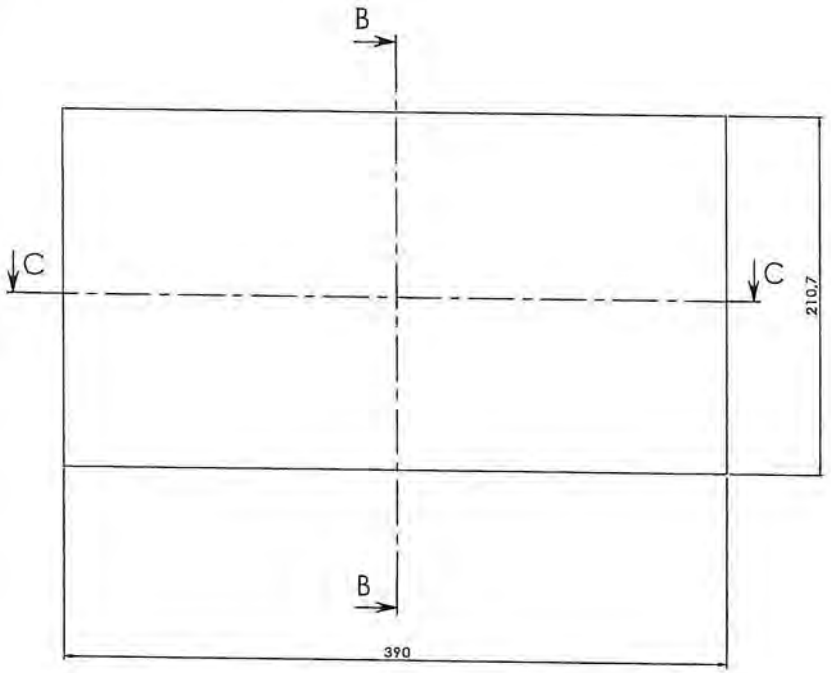
B-B

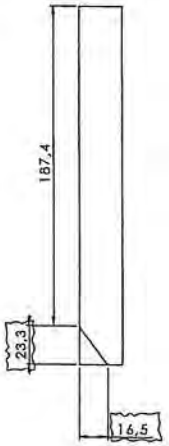
c	Tilpasset leverandørs krav.	KDU	07.09.05
b	Ændret mål.	RSV	31.08.05
Rev.	Revision	Sign.:	Date:

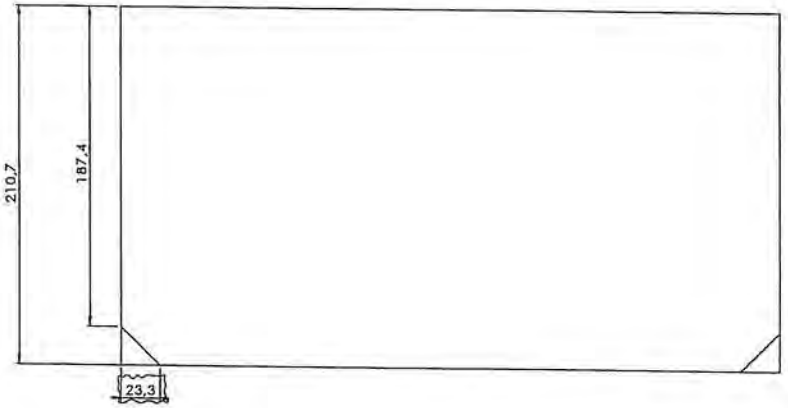
General tolerance:	±1mm, -2mm.
Material:	Vermiculite v-1100 Mk.2
Weight:	1,51 kg
Model no.	-
Drawingtype:	Emnelægning
Location of file:	[illegible]

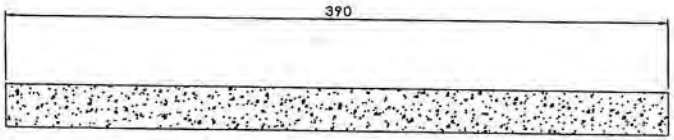
Title:	Sten over tertlærboks	Construction: KDU 25.01.05
		Released: KDU 04.07.05
		Format: A2
	Morsø 8100	Scale: 1:2
		Item no.: 79810500
	morsø	Drawing no.: 8100-42 c

Dato af print: 23-5-2008

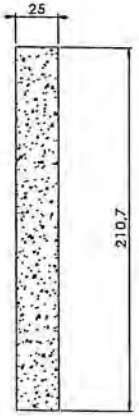




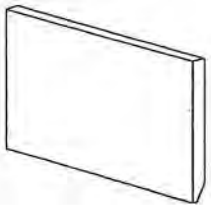




C-C

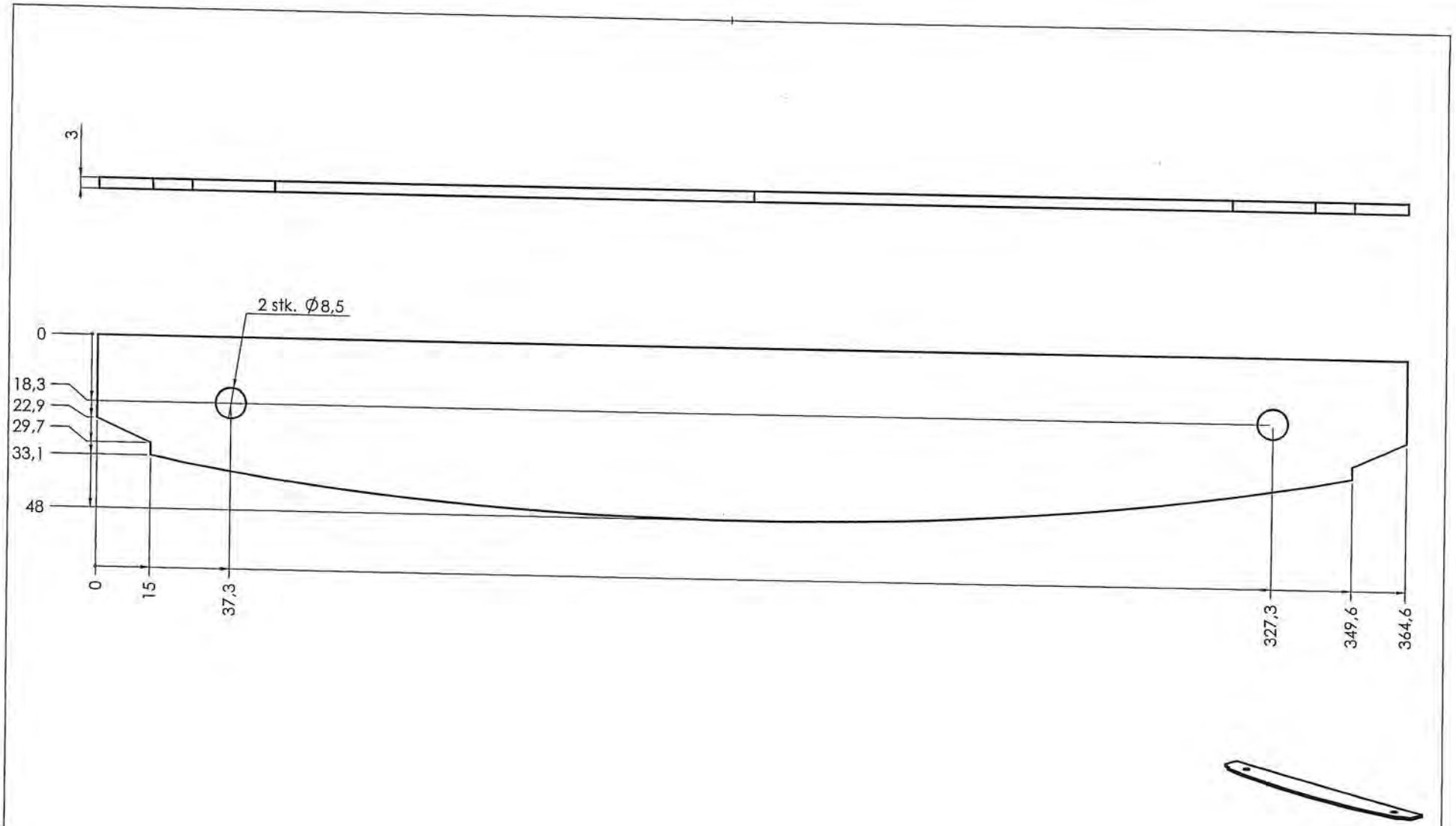


B-B



b	Tilpasset leverandørens krav.			KDU	19.09.05
Rev.	Revision			Sign.:	Date:
		Title:	Construction:	KDU	28.01.05
General tolerance: +1mm, -2mm.		Røgvendeplade øverst	Released:	KDU	04.07.05
Material:	Vermiculite V-1100 ML2		Format:	A2	
Weight:	1,23 kg		Scale:	1:2	
Model no.:	-	Morsø 8100	Item no.:	79810600	
Drawingtype:	Emnelegning	morsø	Drawing no.:	8100-43 b	
Location of file:					

3-52 + 8

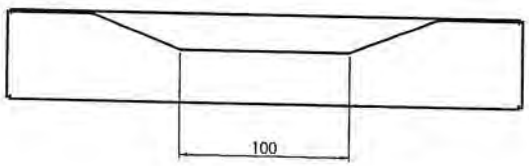


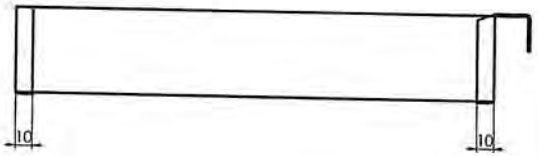
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	
Material:	Rustfri stål
Weight:	0,36 kg
Model no.	-
Drawingtype:	Emnetegning
Location of file:	

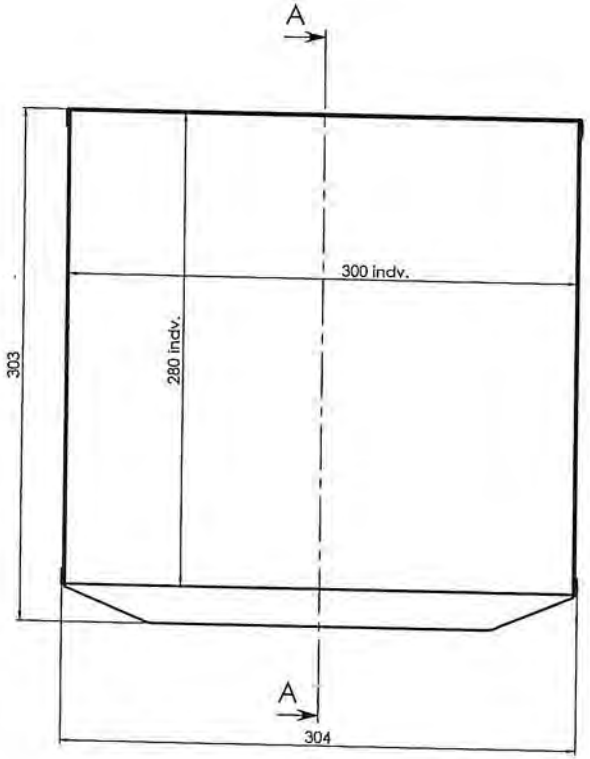
Rev.	Revisions	Sign.:	Date:
Title:	Construction:	KDU	18.01.05
Befæstigelsesplade	Released:	KDU	29.09.05
røgvendeplade	Format:	A3	
Morsø 8100	Scale:	1:1	
	Itemno.:	71811161	
morsø	Drawing no.:	8100-50 a	

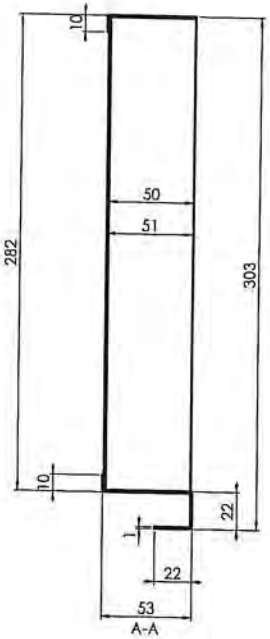
Dato: 29-09-2005

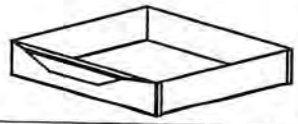
3-53



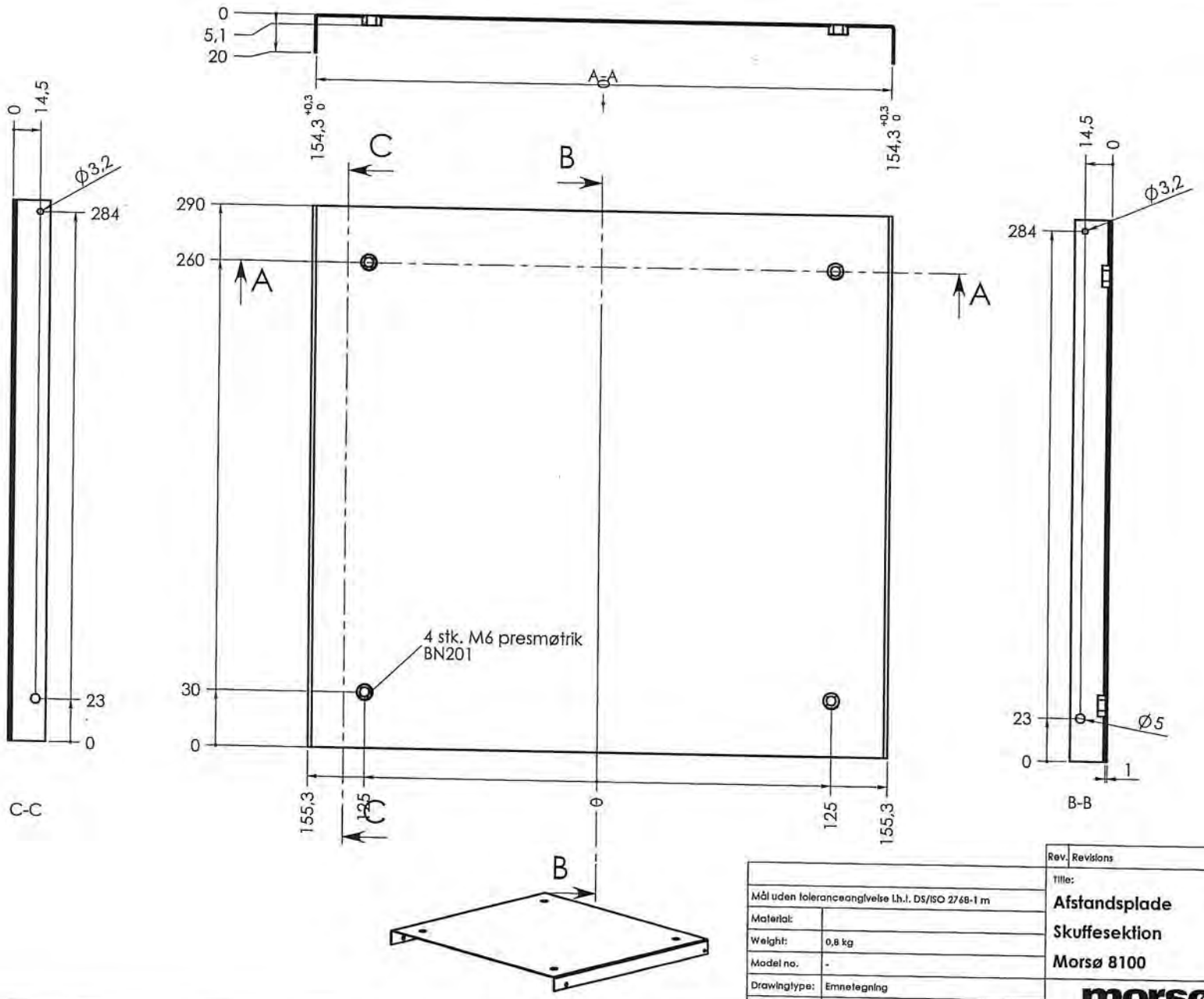








		Rev.	Revisions	Sign.:	Date:
Måtuden toleranceangivelse i h.t. DS/ISO 2768-1 m		Title: Askeskuffe 8100	Construction:	KDU	24.01.05
Material:	Galv. plade		Released:	KDU	29.09.05
Weight:	1,35 kg		Format:	A2	
Model no.	-	Morsø 8100	Scale:	1:2	
Drawingtype:	Emnelægning		Itemno.:	71811300	
Location of file:		morsø	Drawing no.:	8100-52 a	



		Rev.	Revisions	Sign.:	Date:
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m		Title: Afstandsplade Skuffesektion Morsø 8100	Construction:	KDU	20.01.05
Material:			Released:	KDU	29.09.05
Weight:	0,8 kg		Format:	A3	
Model no.	-		Scale:	1:2	
Drawingtype:	Emnetegning		Itemno.:	71812600	
Location of file:		morsø	Drawing no.:	8100-60 a	

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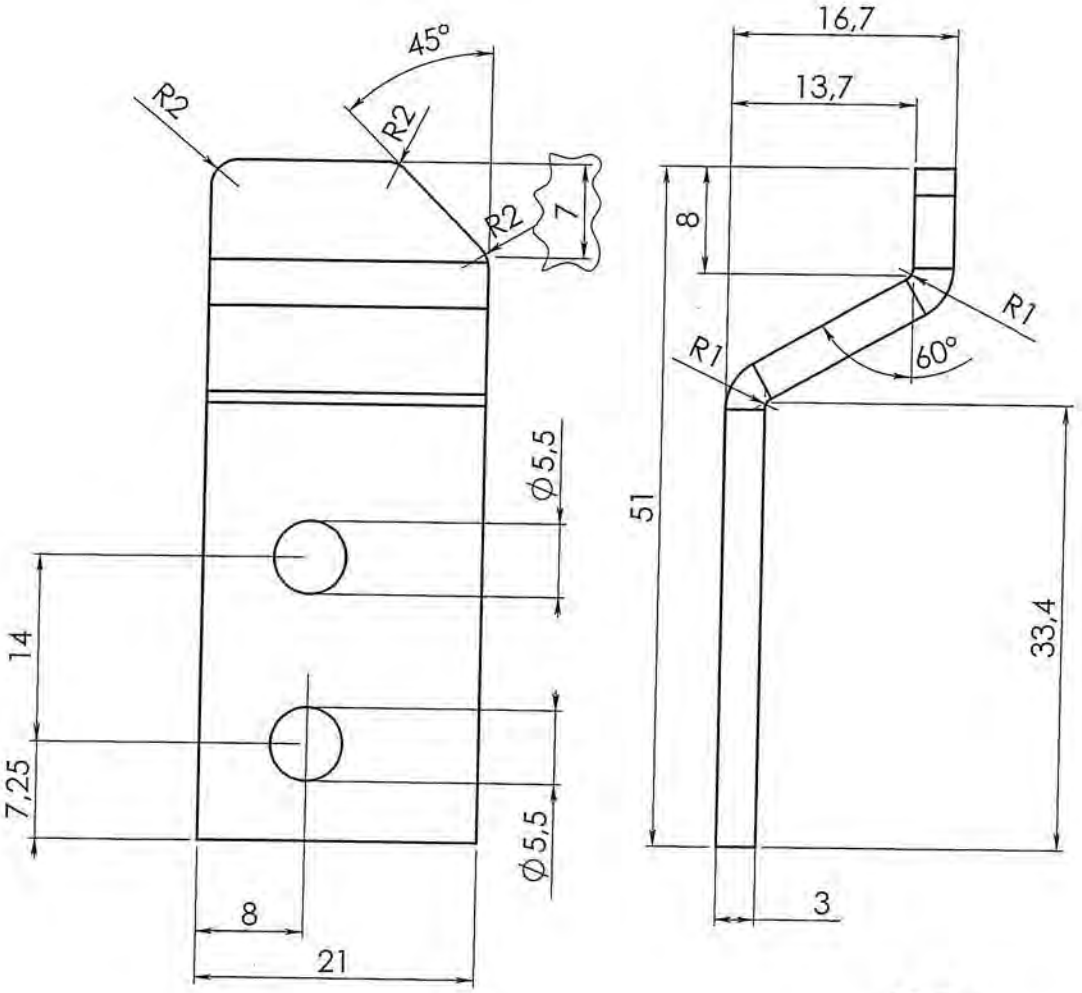
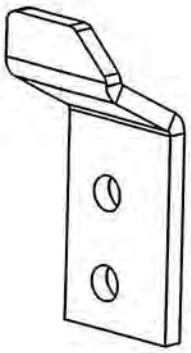




Rev.	Revisions	Sign.:	Date:

Title: **Beslag f. lukkepal**

Morsø 8100

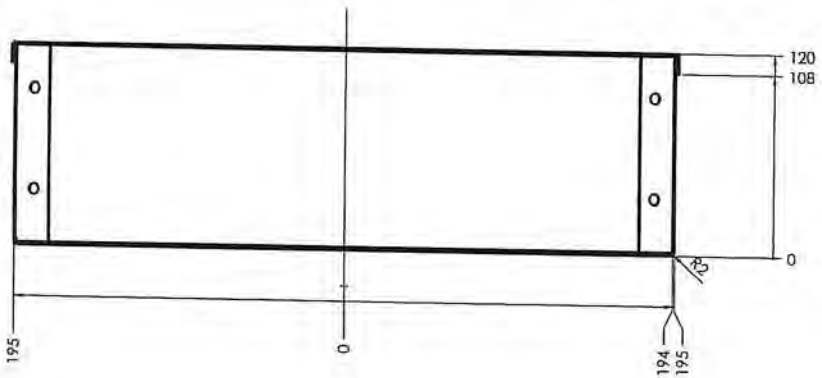
Construction:	KDU	25.02.05
Released:	KDU	29.09.05
Format:	A4	
Scale:	2:1	
Itemno.:	71813300	

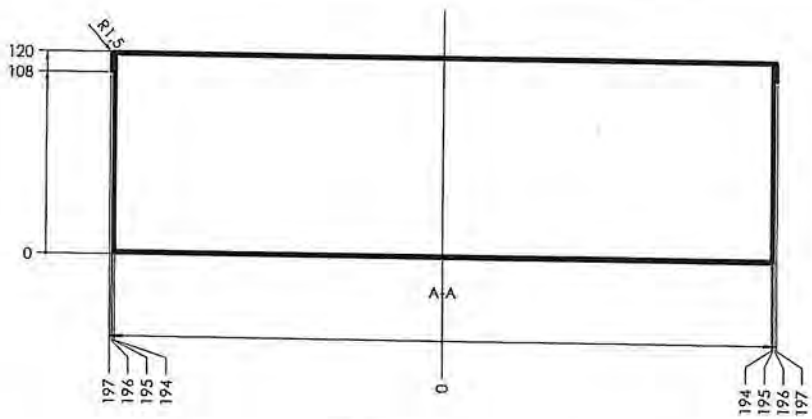
morsø — By appointment to the Royal Danish Court

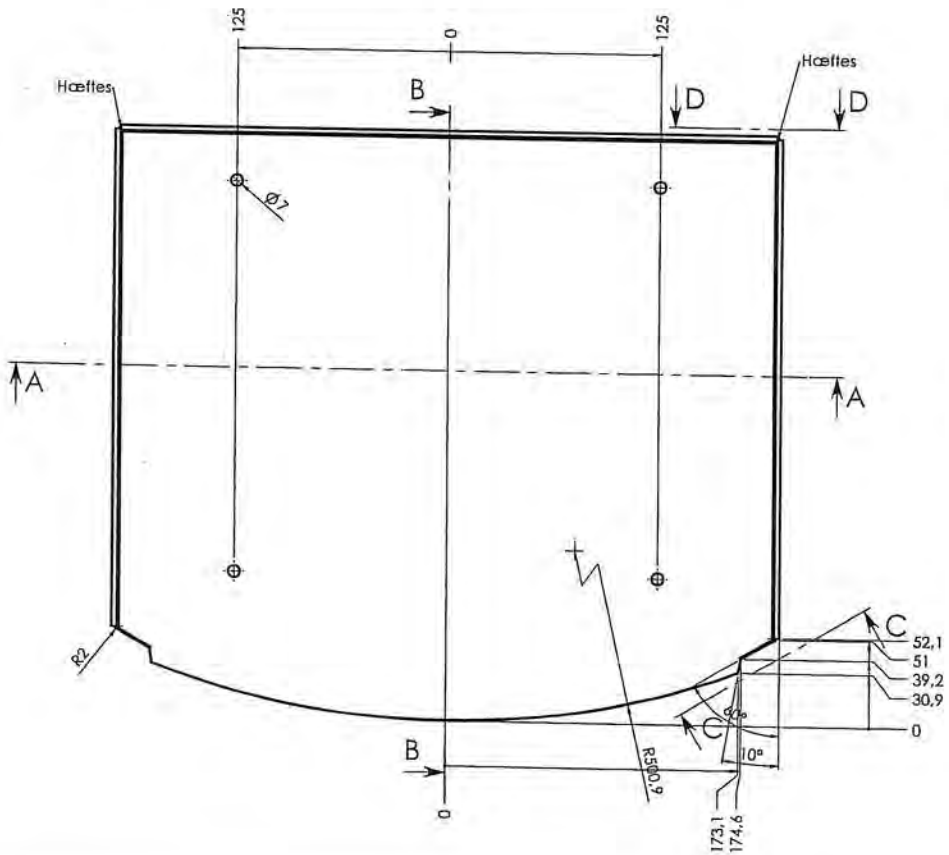
Drawing no.: **8100-63 a**

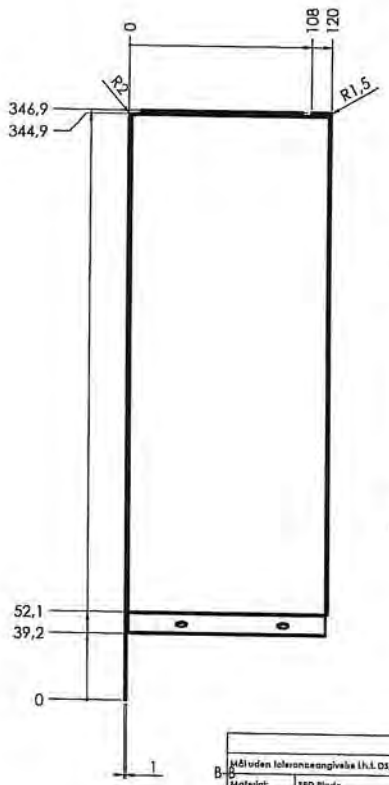
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	
Material:	SPD Plade
Weight:	0,03 kg
Model no.	-
Drawingtype:	Emnetegning
Location of file:	U:\UDV\tegninger\8100\8100-63 Beslag for lukkepal 2.5D.PRT

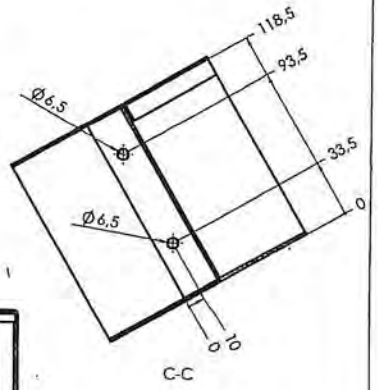
Date of print: 27-10-2005

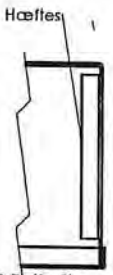


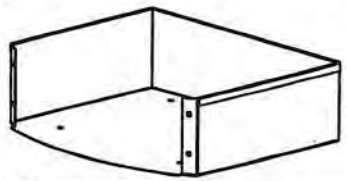












Rev.	Revision:			Sign.:	Date:
Måltuden toleranceangivelse i h.t. DS/ISO 2768-1 m		Title: Skuffekasse	Construction:	KDU	21.01.05
Material:	3PD Plade		Released:	KDU	29.09.05
Weight:	2.07 kg		Format:	A2	
Model no.:	-	Morsø 8100	Scale:	1:1	
Drawingtype:	Emnefegning		Itemno.:	71812700	
Location of file:		morsø	Drawing no.:	8100-64 a	

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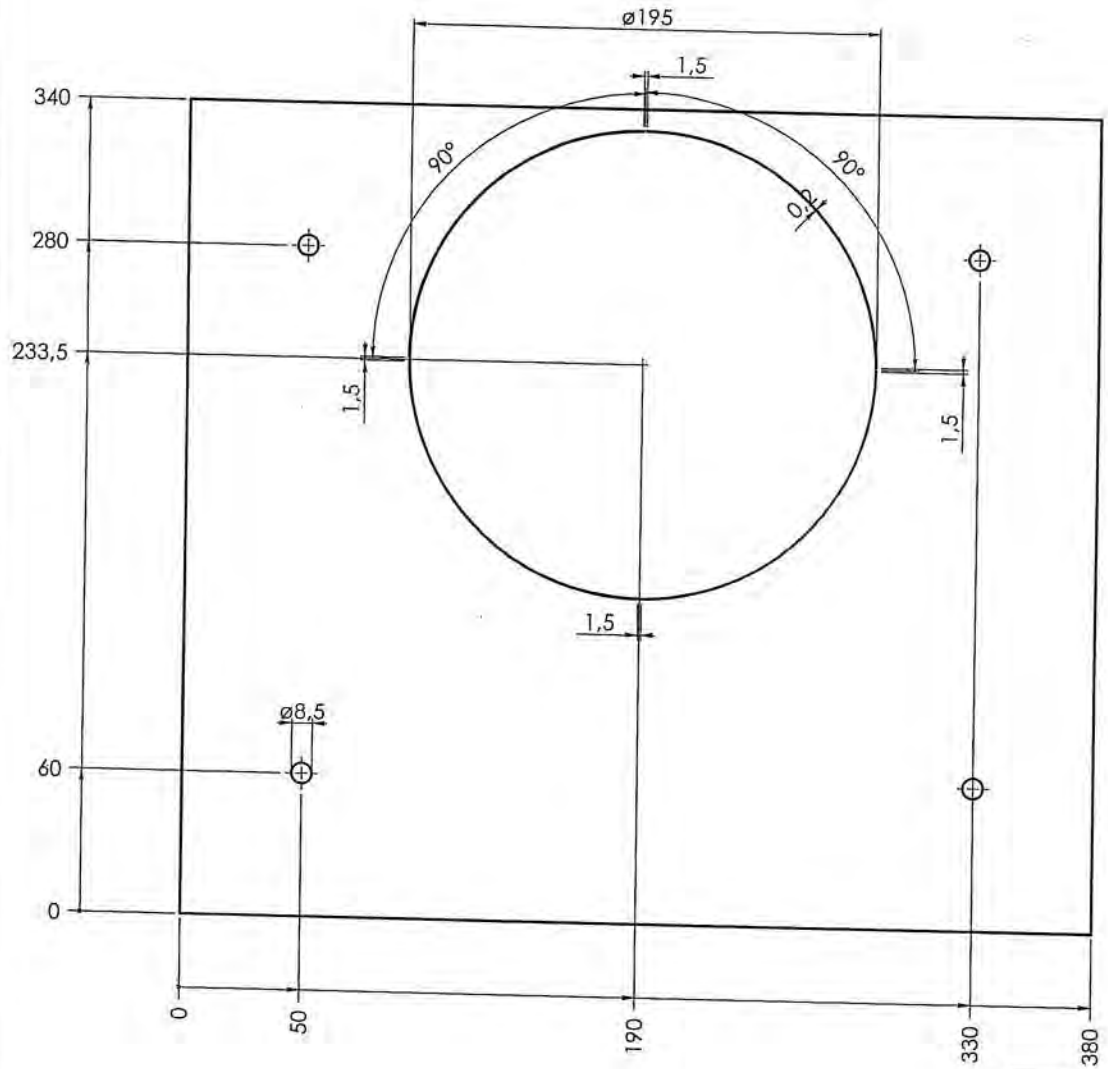
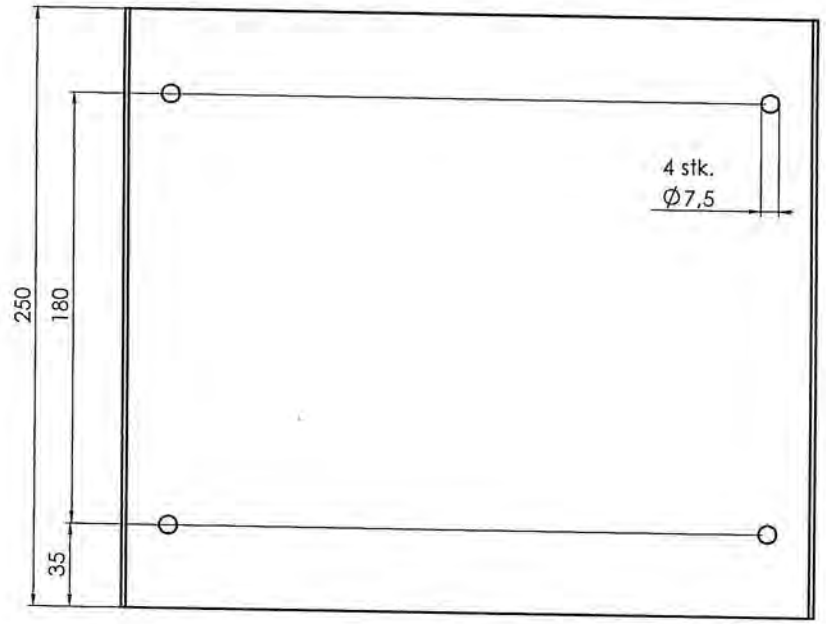
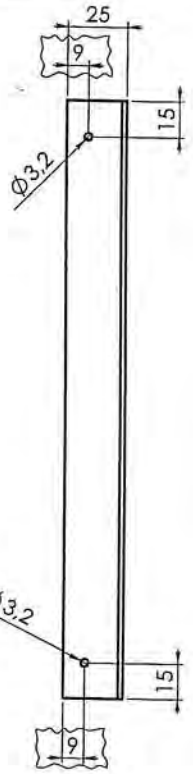
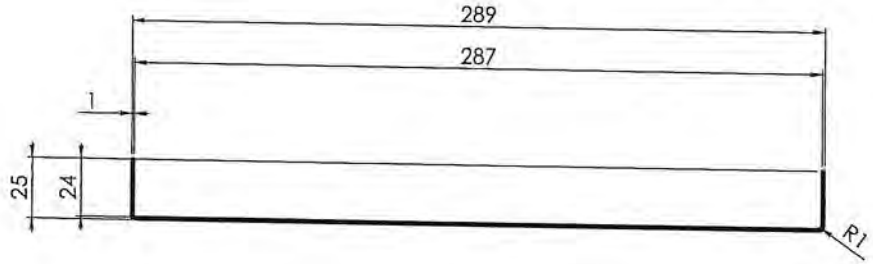


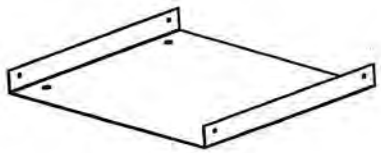
		Rev.	Revisions	Sign.:	Date:
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m		Title: Stråleplade bag	Construction:	KDU	19.01.05
Material:	Galvaniseret plade		Released:	KDU	29.09.05
Weight:	1,01 kg		Format:	A3	
Model no.	-	Morsø 8100	Scale:	1:2	
Drawingtype:	Emnetegning		Itemno.:	71811400	
Location of file:		morsø	Drawing no.:	8100-65 a	

Date of print: 27-10-2005





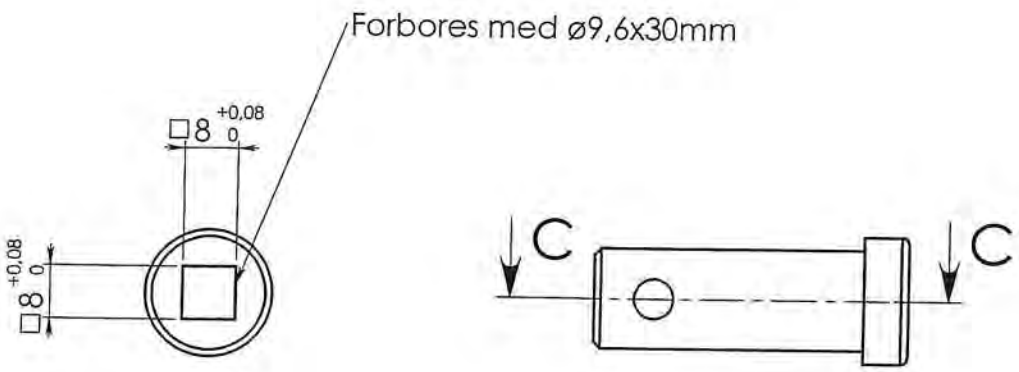


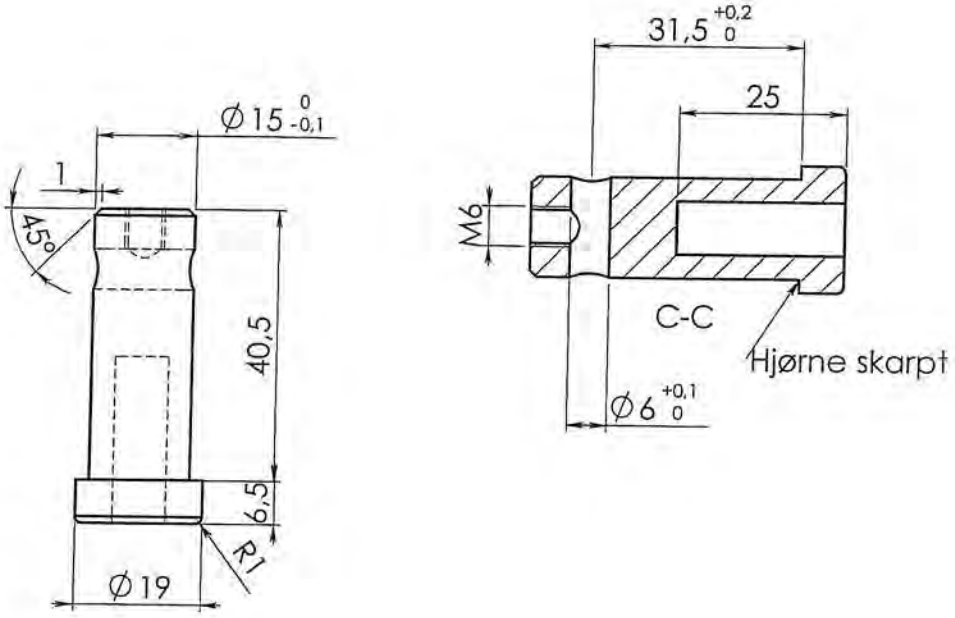


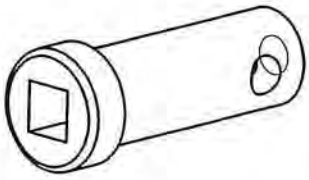
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	
Material:	SPD Plade
Weight:	0,66 kg
Model no.	-
Drawingtype:	Emnetegning
Location of file:	

Rev.	Revisions	Sign.:	Date:
Title:	Construction:	KDU	21.01.05
Mont.plade f. skuffesektion	Released:	KDU	29.09.05
	Format:	A3	
	Scale:	1:2	
Morsø 8100	Item no.:	71812800	
morsø	Drawing no.:	8100-66 a	

3-64 af 3-103

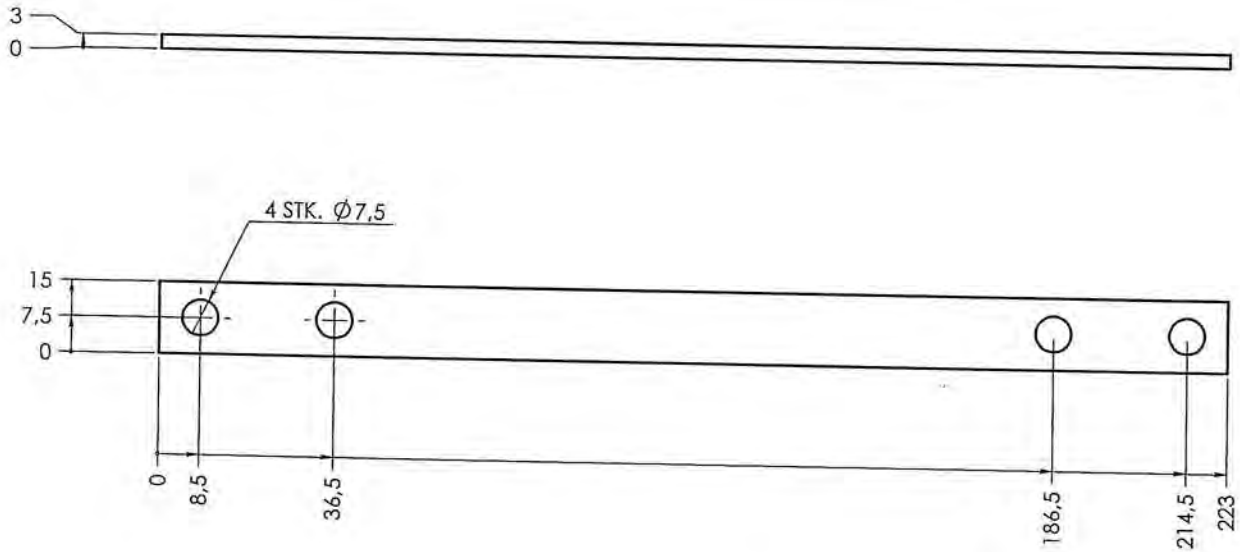




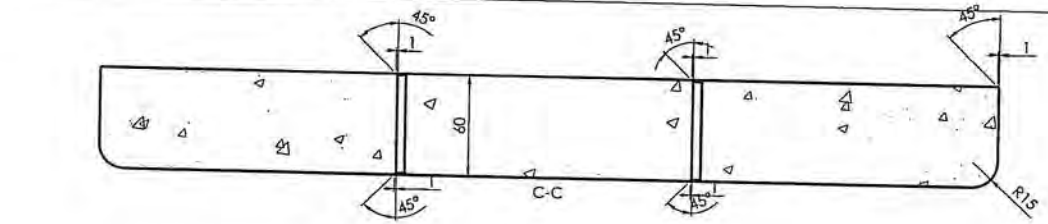


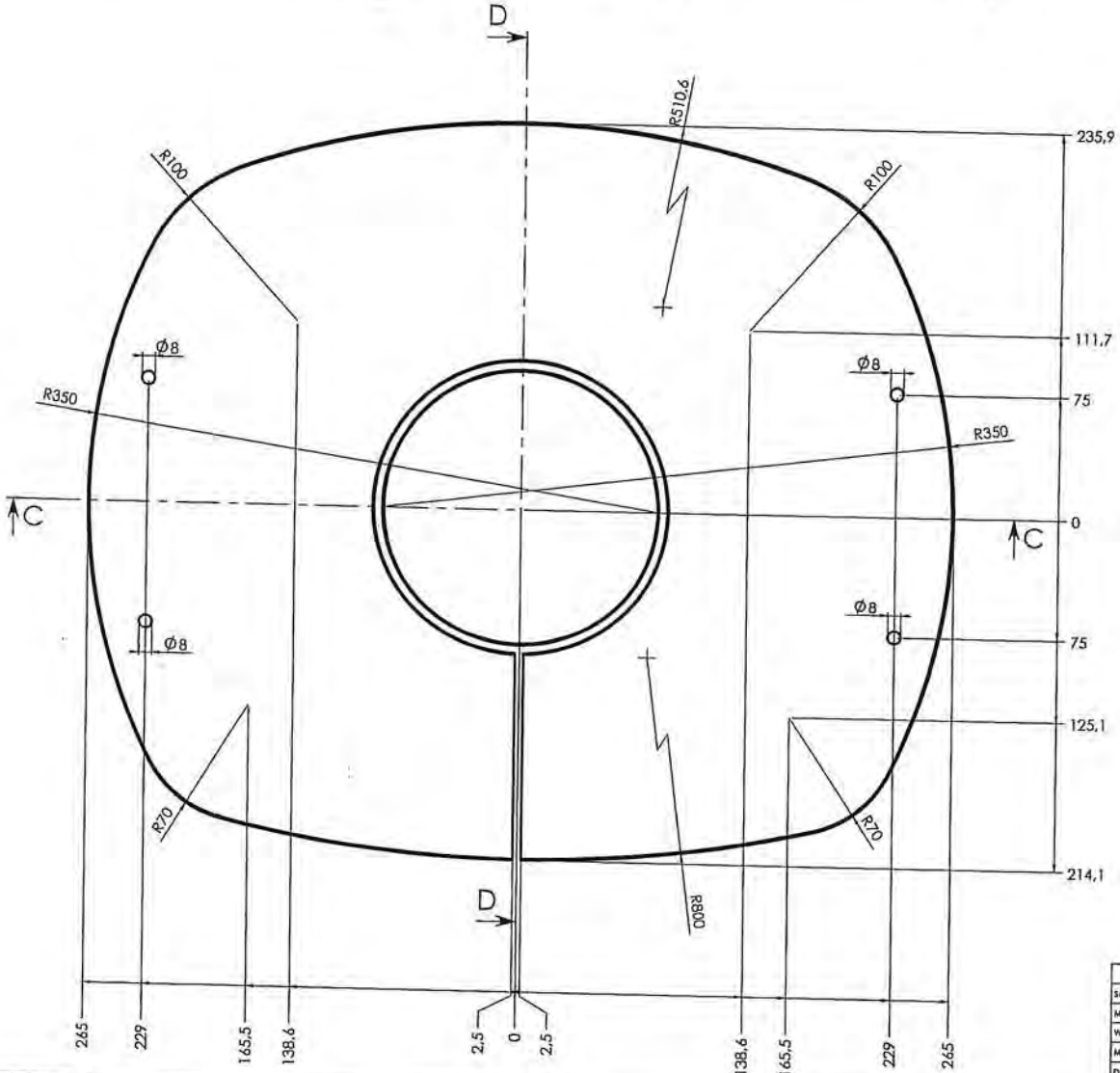
		Rev.	Revisions		Sign.:	Date:
		Title:		Construction:	KDU	31.01.05
Se tegning		**Døraksel 8100**		Released:	KDU	29.09.05
Material:	Rustfri stål			Format:	A4	
Weight:	0,05 kg			Scale:	1:1	
Model no.	-	**Morsø 8100**		Itemno.:	71813061	
Drawingtype:	Emnetegning	morsø		Drawing no.:	8100-71 a	
Location of file:	U:\UDV\Tegninger\8100\8100-71 Døraksel 8100.SLDPRT					

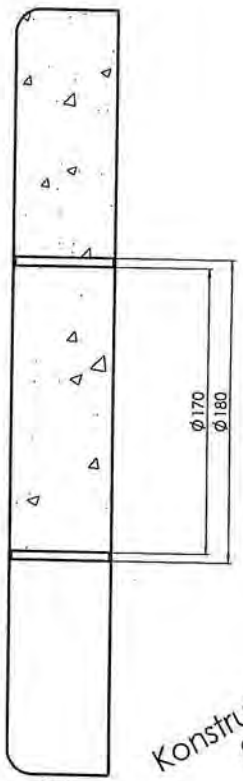
Date of print: 27-10-2005



		Rev.	Revisions		Sign.:	Date:
			Title:	Construction:	KDU	02.02.05
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m			Lus f. dæksel	Released:	KDU	29.09.05
Material:	SPD Plade			Format:	A3	
Weight:	0,07 kg			Scale:	1:1	
Model no.	-		Morsø 8100	Itemno.:	71813200	
Drawingtype:	Emnetegning		morsø	Drawing no.:	8100-73 a	
Location of file:						







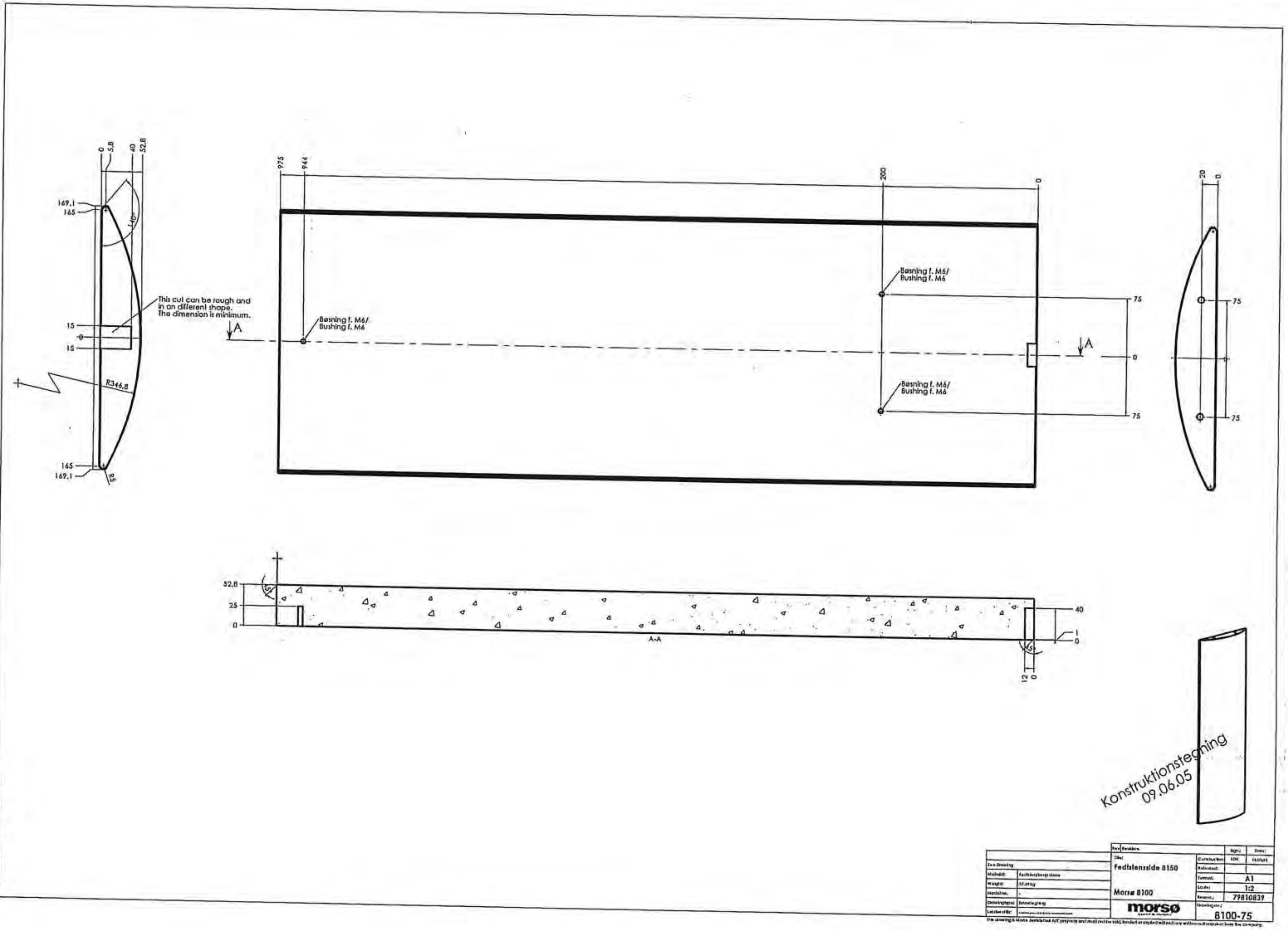
Konstruktionstegning
09.06.05

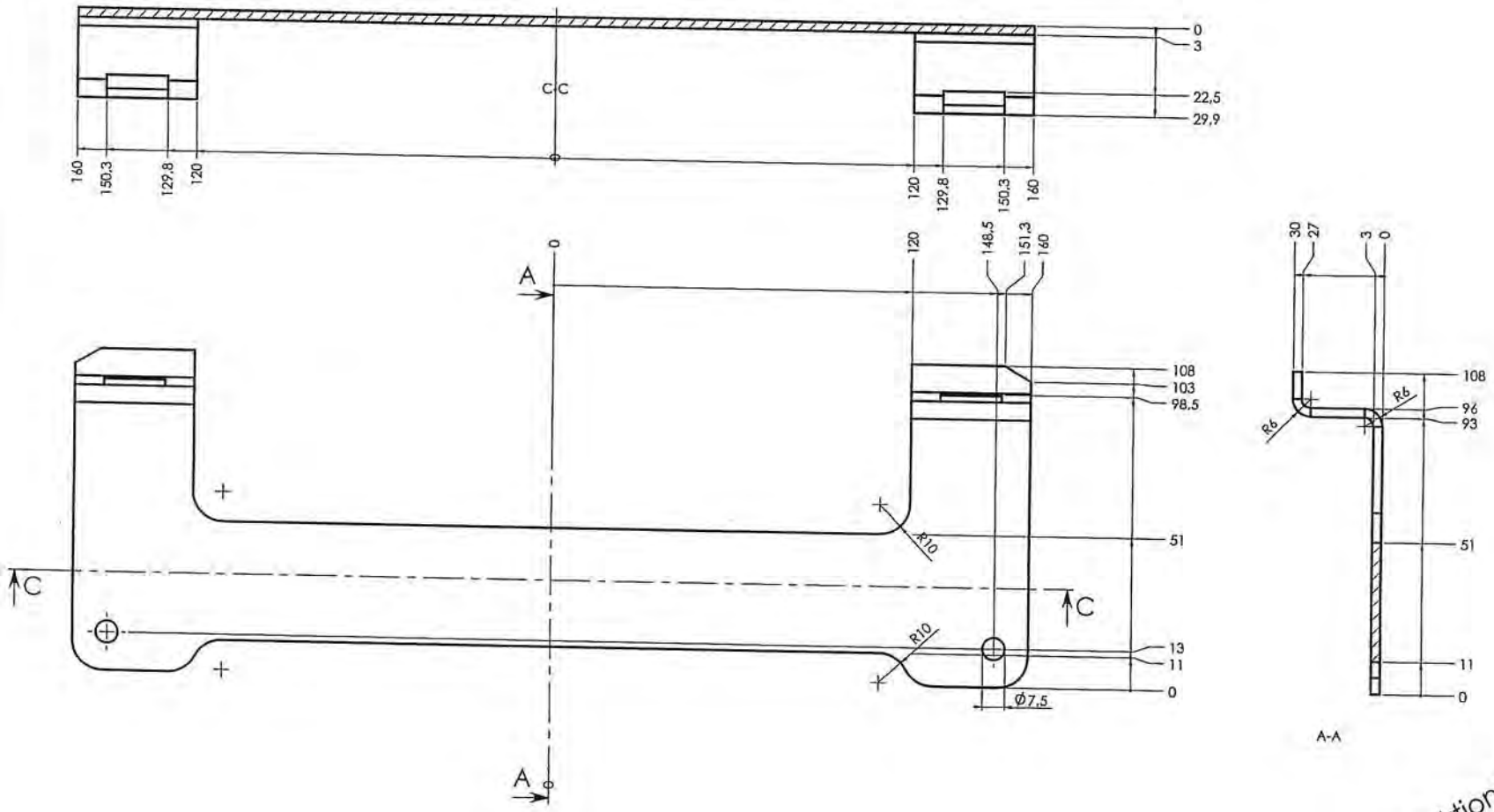
Rev.	Revision	Sign.:	Date:
	Title: Fedtstenstop 8100	Construction: KDU	14.03.05
		Released:	
		Format:	A2
	Morsø 8100	Scale:	1:2
		Item no.:	79810739
	morsø	Drawing no.:	8100-74

See Drawing:	
Material:	
Weight:	33.26 kg
Model no.:	
Drawingtype:	Emnefegning
Location of file:	

3-00 af 3-10-03

Date of print: 27-10-2003


Bøsning f. M6/
Bushing f. M6
This cut can be rough and in an different shape. The dimension is minimum.
R346,8
R5
A-A
Konstruktionstegning
09.06.05
Title:
Fedtstensside 8150
Morsø 8100
Scale:
1:2
Format:
A1
79810839
Drawing no.:
8100-75
morsø



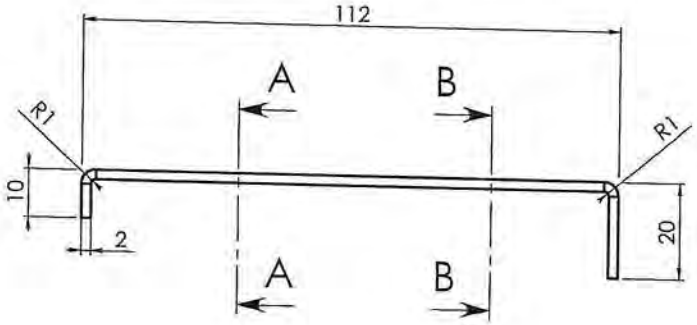
Konstruktionstegning
14.03.05

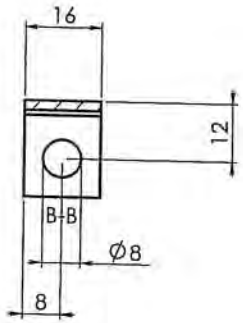
Mål uden tolerance angivelse i h.t. DS/ISO 2768-1 m			
Material:	SPD Plade		
Weight:	0.46 kg		
Model no.	-		
Drawingtype:	Emnelægning		
Location of file:			

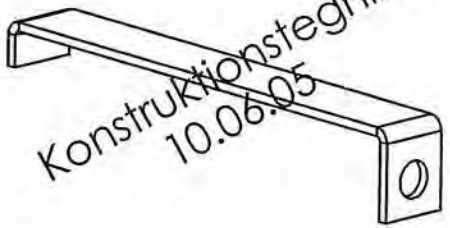
Rev.	Revision	Sign.:	Date:
Title:		Construction:	KDU 14.03.05
Seler Fedtstensovn		Released:	
		Format:	A2
Morsø 8100		Scale:	1:1
		Item no.:	71813800
morsø		Drawing no.:	8100-76

3-04 of 3-103

Date of print: 27-10-2005



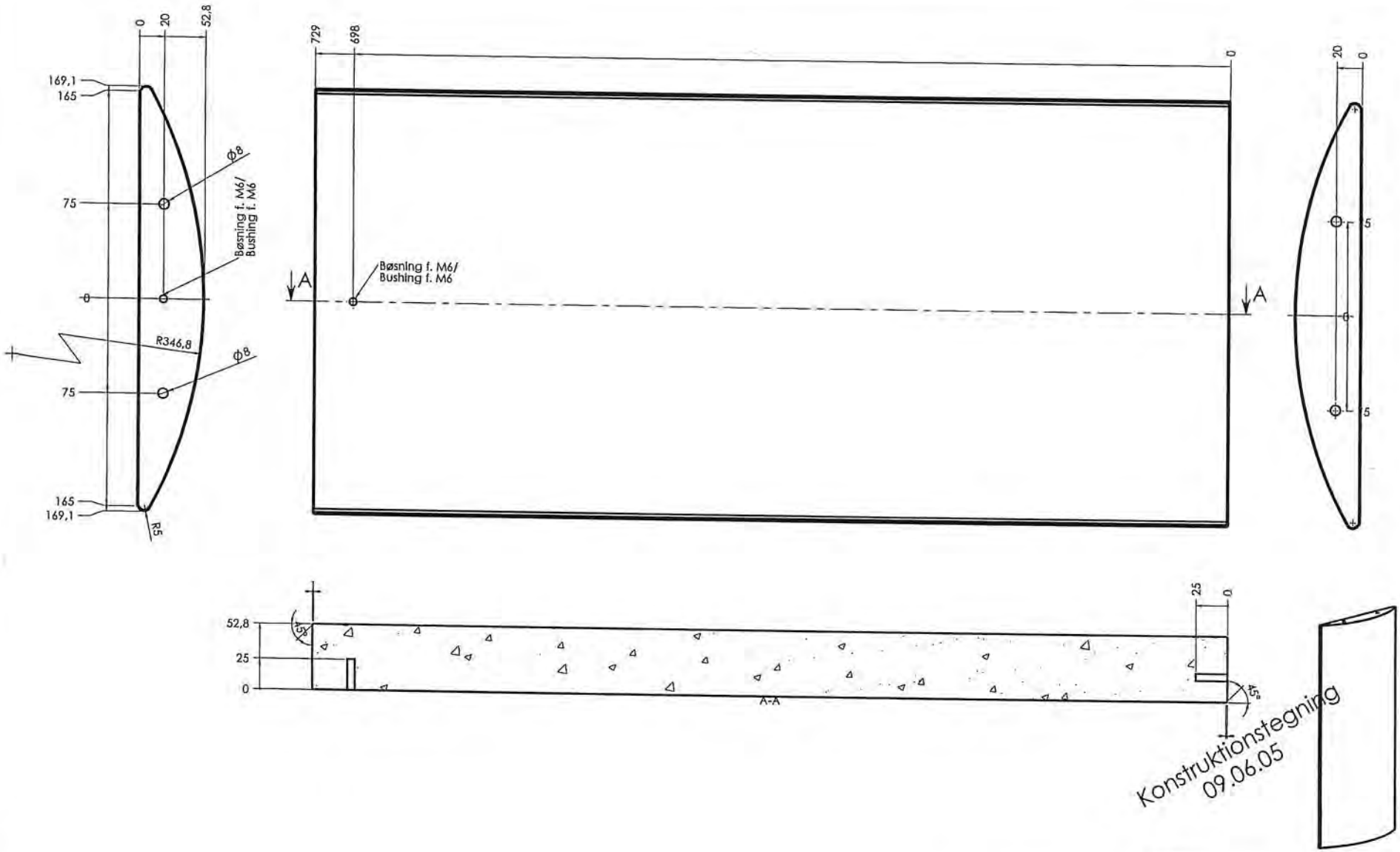




		Rev.	Revisions	Sign.:	Date:
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m		Title: Bøjle f. fedtsten	Construction:	KDU	10.03.05
Material:	SPD Plade		Released:		
Weight:	0,03 kg		Format:	A3	
Model no.	-	Morsø 8100	Scale:	1:1	
Drawingtype:	Emnetegning		Itemno.:	71813400	
Location of file:		morsø	Drawing no.:	8100-77	

Date of print: 27-10-2005

8-05-04-05-108



Konstruktionstegning
09.06.05

		Rev.	Revisions	Sign.:	Date:
		Title:	Fedtstensside 8151	Construction: KDU	15.03.05
See Drawing				Released:	
Material:	Fedtsten/Soap stone			Format:	A2
Weight:	28.2 kg		Morsø 8100	Scale:	1:2
Model no.	-			Item no.:	79810939
Drawingtype:	Emnetegning	morsø		Drawing no.:	8100-78
Location of file:					

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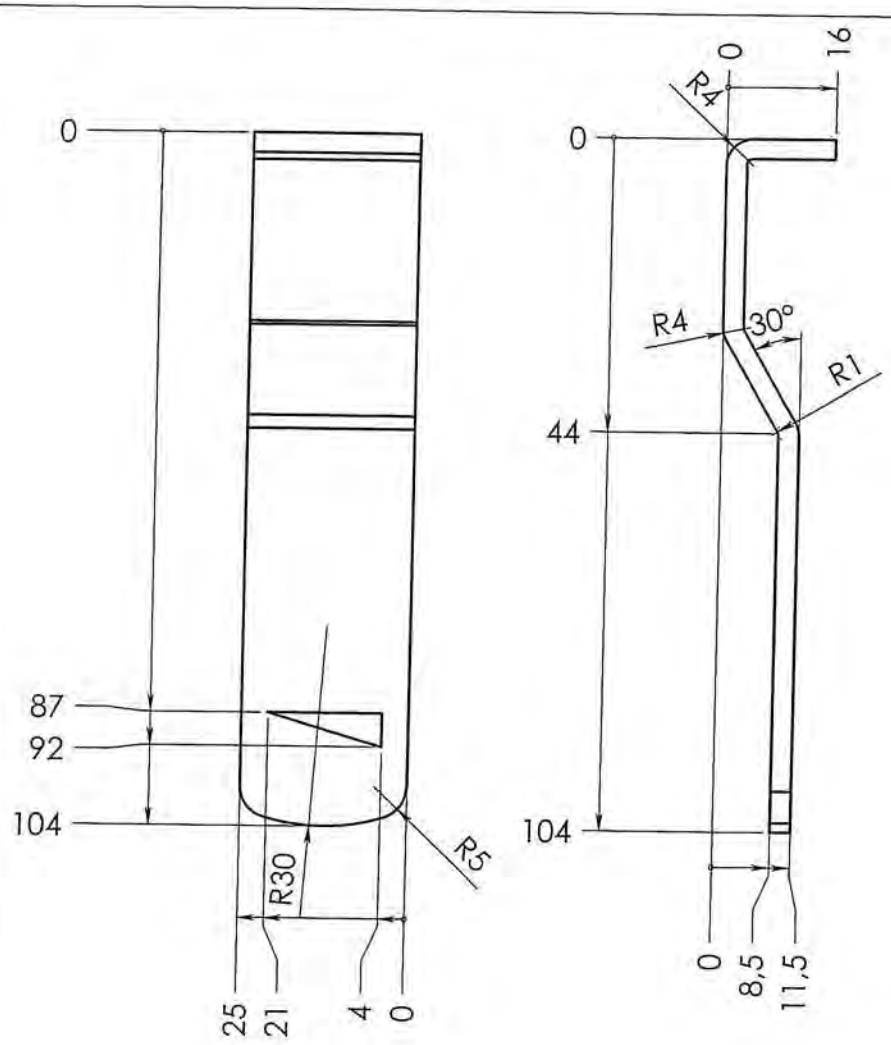
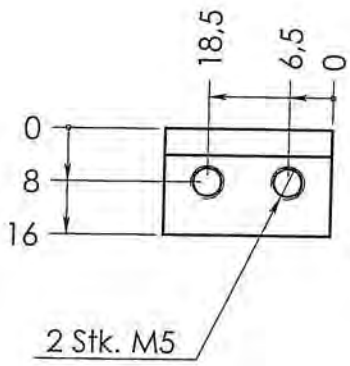
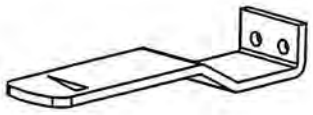
Date of print: 27-10-2005





Konstruktionstegning
04.10.05



Rev.	Revisions	Sign.:	Date:

Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	
Material:	Rustfri stål - Børstet
Weight:	0,07 kg
Model no.	-
Drawingtype:	Emnetegning
Location of file:	U:\UDV\Tegninger\8100\8100-79 Greb sek. f. fedtstensovn.SLDPRT

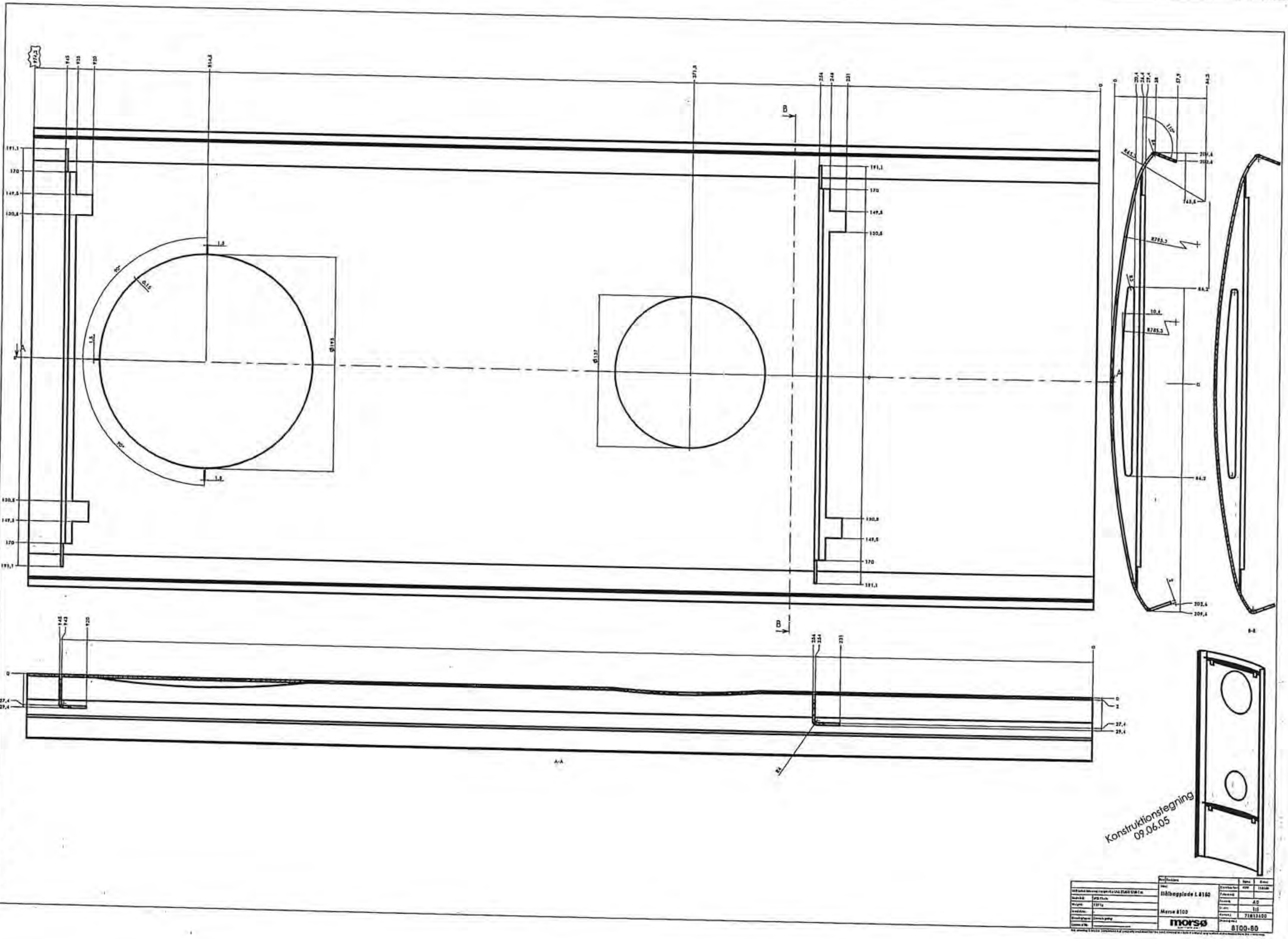
Title:
Greb sek. f. fedtstensovn

Morsø 8100

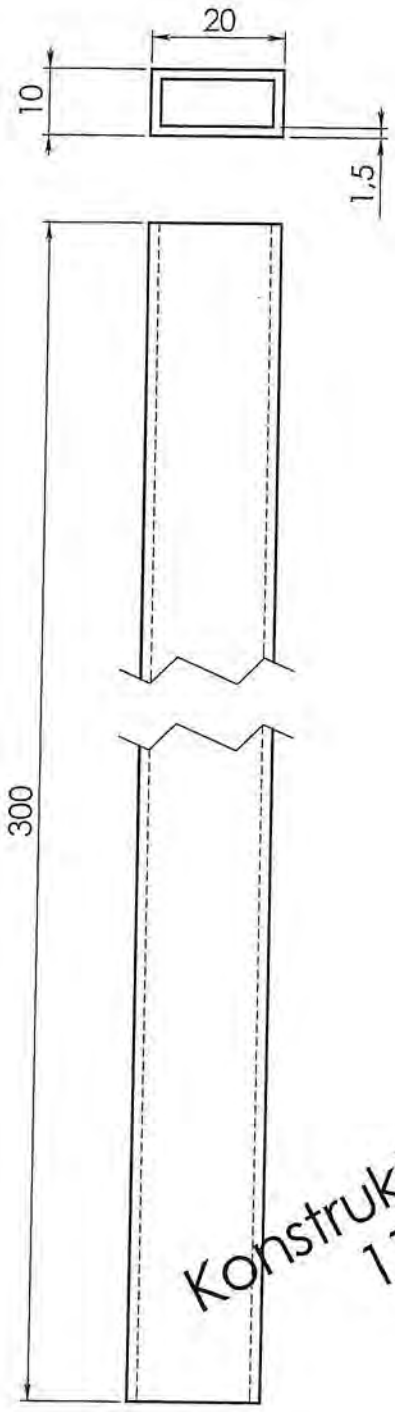
morsø
By appointment to HM the Royal Danish Court

Construction:	KDU	11.03.05
Released:		
Format:	A4	
Scale:	1:1	
Itemno.:	71813561	
Drawing no.:	8100-79	

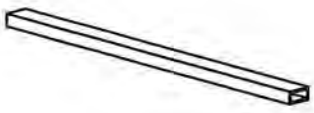
Date of print: 27-10-2005


B
A
A-A
B-B
Konstruktionstegning
09.06.05
Stålbagplade L 8100
Morsø 8100
morsø
A3
1:1
71813100
8100-80

3-68 of 3-103



Konstruktionstegning
11.03.05



Rev.	Revisions	Sign.:	Date:

Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m		Title: Løs hulprofil f. fedtstensbrik	Construction:	KDU 11.03.05
Material:	SPD Plade		Released:	
Weight:	0,19 kg		Format:	A4
Model no.			Scale:	1:1
Drawingtype:	Emnetegning	Morsø 8100	Itemno.:	71813700
Location of file:	D:\UDV\tegninger\8100\8100-81 løs profil f. fedtstenstop.SLDPRT	morsø By appointment to the Royal Danish Court	Drawing no.:	8100-81

Date of print: 27-10-2005

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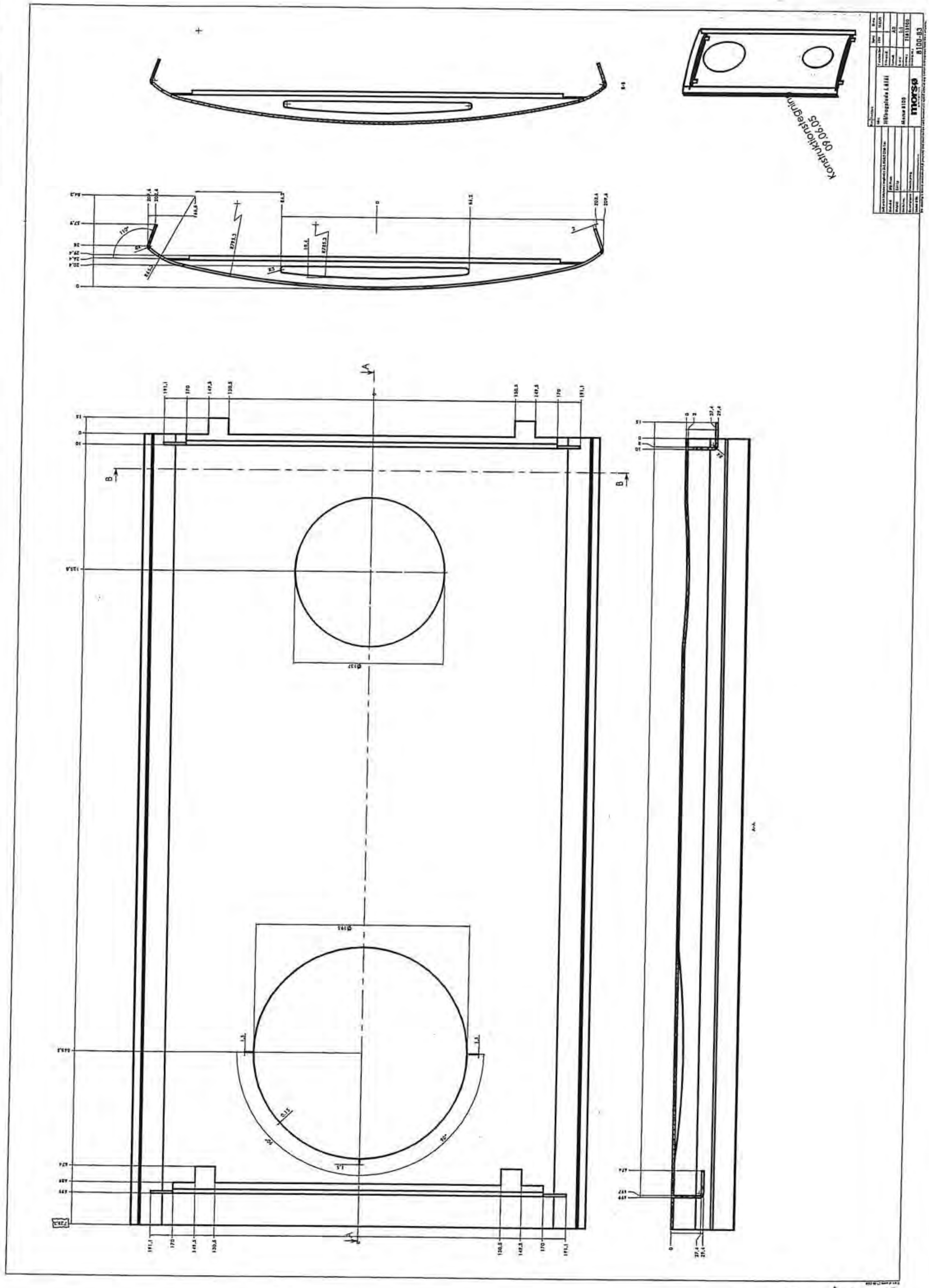
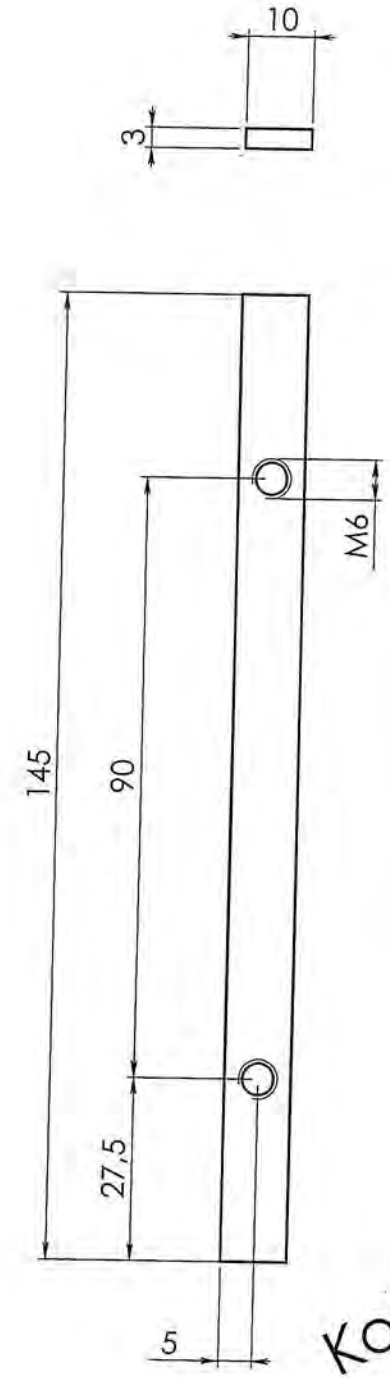


3-70 of 3-103

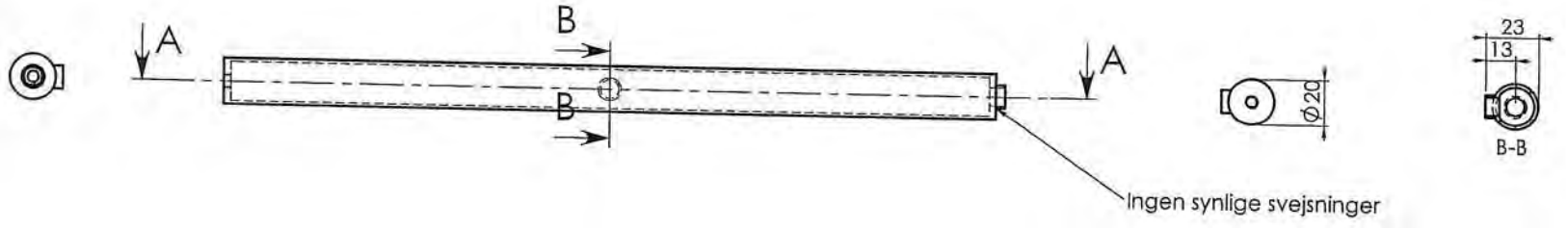


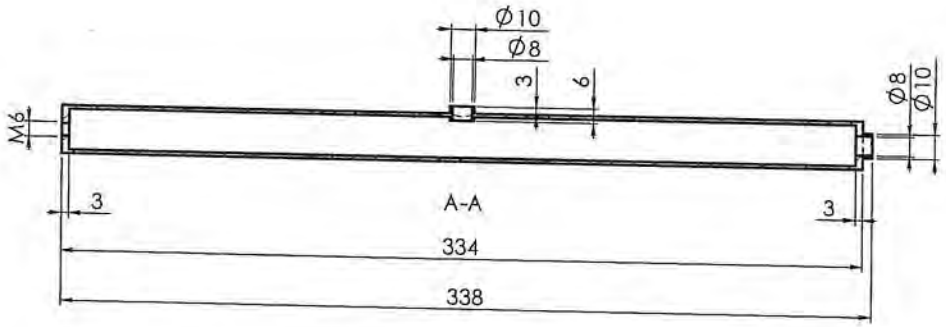
Konstruktionstegning
10.10.05

Rev.	Revisions	Sign.:	Date:

Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m		Title: Lus f. airtightstuds 8100	Construction:	KDU 03.10.05
Material:	Fladstål blanktrukket		Released:	
Weight:	0,03 kg		Format:	A4
Model no.	-	Morsø 8100	Scale:	1:1
Drawingtype:	Emnetegning		Itemno.:	542642
Location of file:	I:\UDV\Tegninger\8100\8100-126 Lus f. airtightstuds 8100.SLDPRT	morsø By appointment to the Royal Danish Court	Drawing no.:	8100-126

Date of print: 27-10-2005



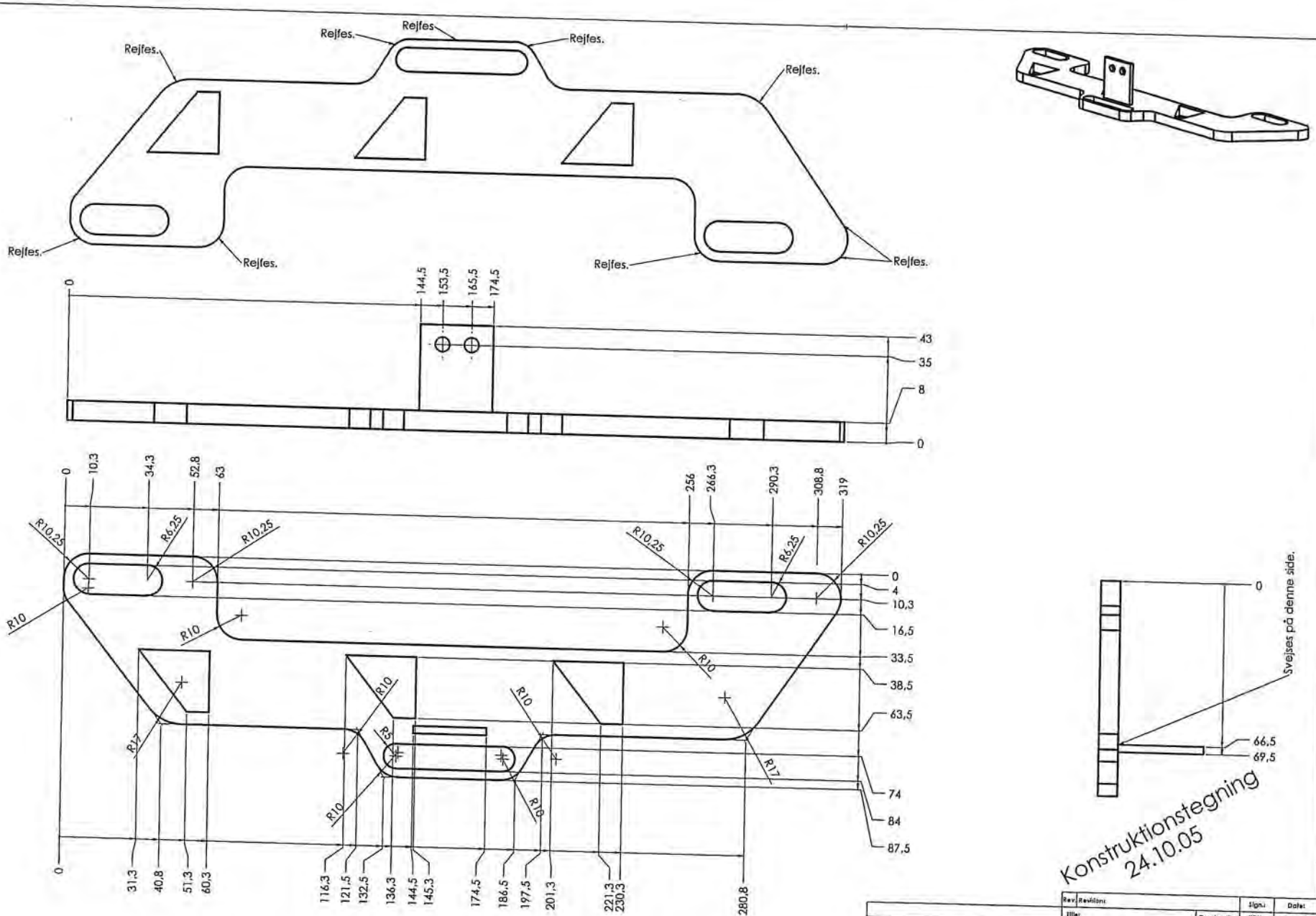


Konstruktionstegning
24.10.05

		Rev.	Revisions	Sign.:	Date:
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m		Title: Rørforrist 8100 NA	Construction:	KDU	24.10.05
Material:	AISI 304		Released:		
Weight:	0,24 kg		Format:	A3	
Model no.	-	Morsø 8100	Scale:	1:2	
Drawingtype:	Emnetegning		Itemno.:	71814361	
Location of file:		morsø	Drawing no.:	8100-127	

3-28 af 3-108

Date of print: 27-10-2005



Konstruktionstegning
24.10.05

Rev.	Revision:	Sign.:	Date:
		KDU	24.10.05

Mål uden toleranceangivelse Ef.t. DS/ISO 2768-1 m	
Material:	SPD Plade
Weight:	0,71 kg
Model no.:	-
Drawingtype:	Emnetegning
Location of file:	

Title:
Sek. spjæld 8100 NA

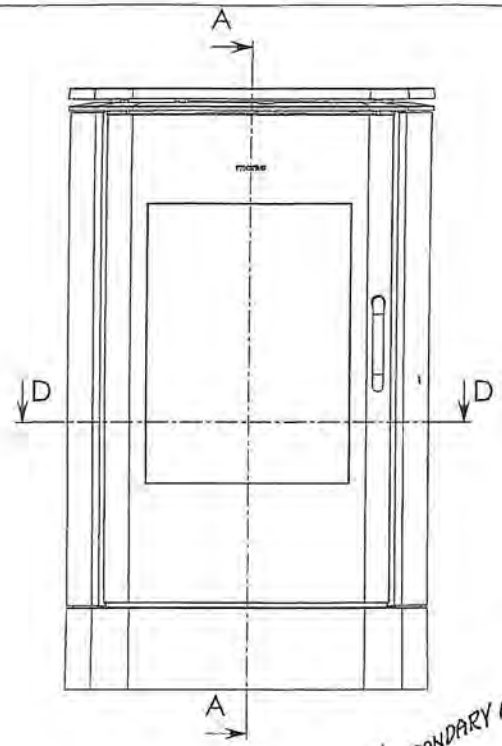
Morsø 8100

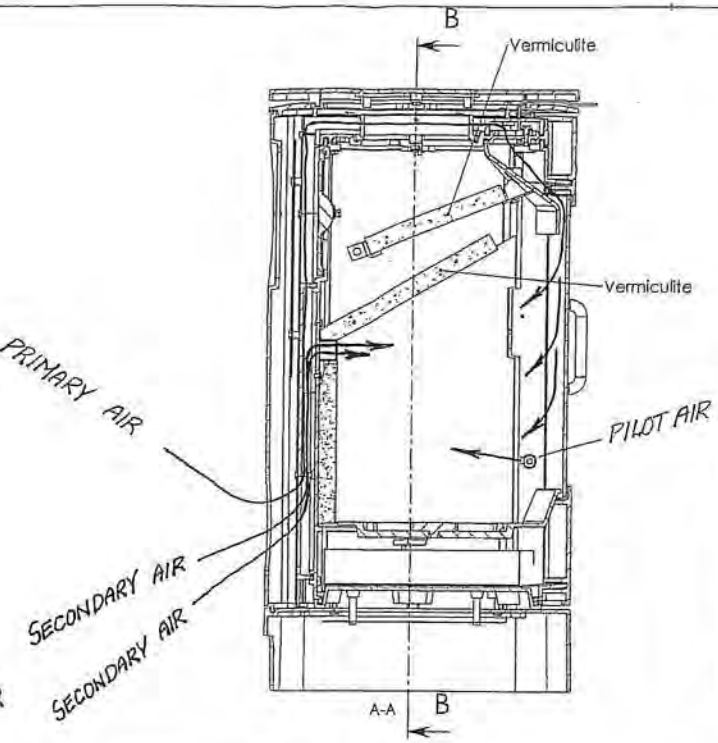
Construction:	KDU
Released:	
Format:	A2
Scale:	1:1
Itemno.:	71814400
Drawing no.:	8100-128

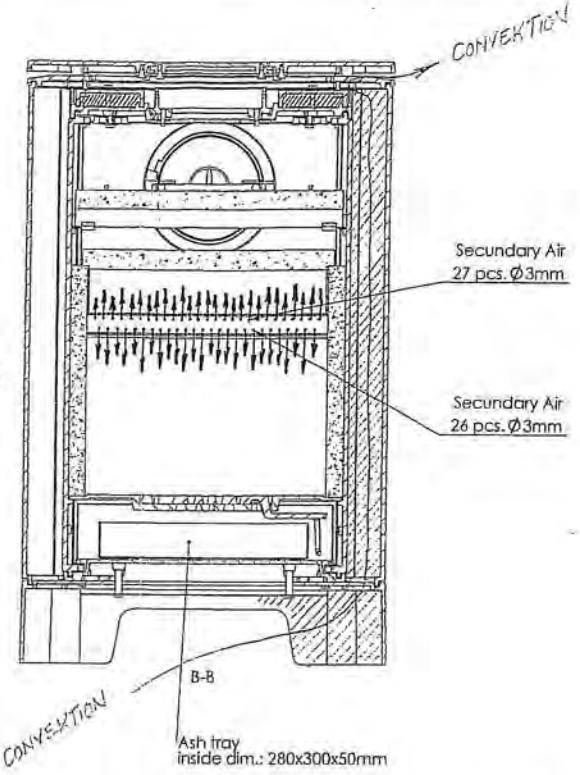
morsø

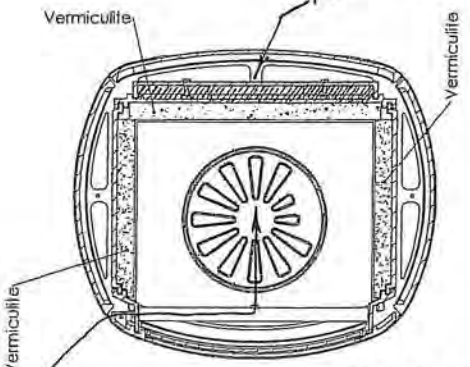
3-28-1-13-102

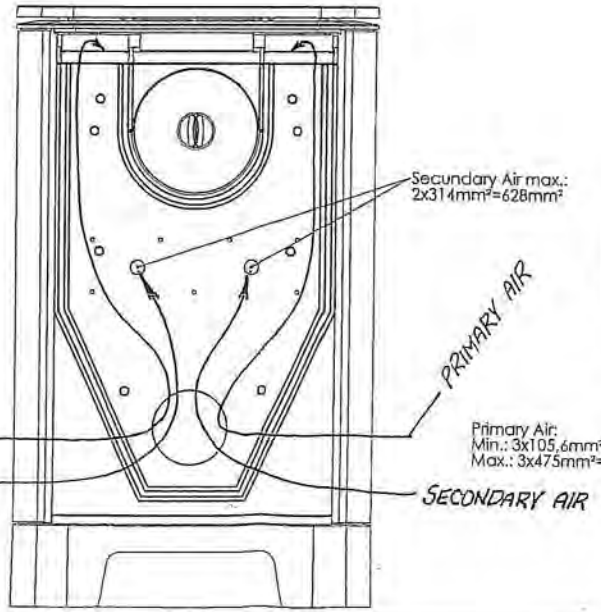
Date of print: 27.10.2005

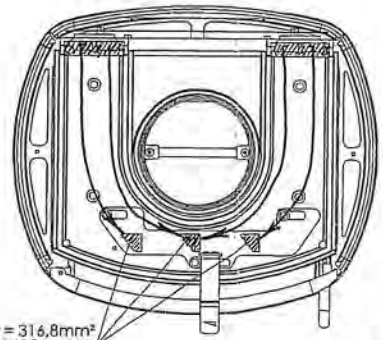


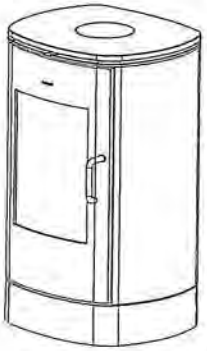










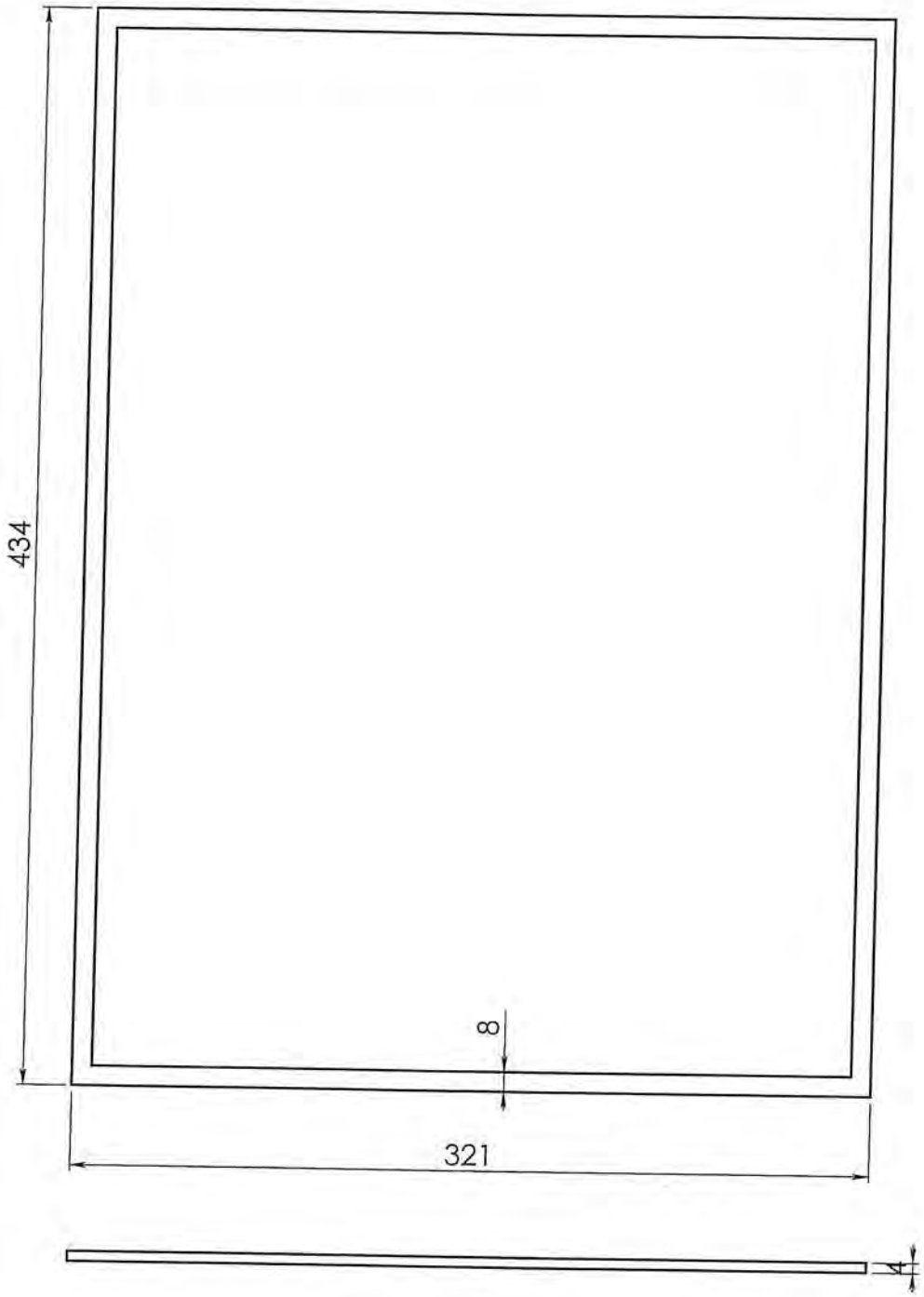


Rev.	Revisions		Sign.:	Date:
	Title: Air flow diagram 8140 NA Morsø 8100	Construction:	RJSV	28.10.05V
		Released:		
		Format:	A2	
		Scale:	1:5	
		Remno.:		
		Drawing no.:	8100-129 a	

Dim. without indicational margin acc. to ISO Norm No.: 8062 CT3

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

Date of print: 25-10-2005



Rev.	Revisions	Sign.:	Date:

Title:

Glasbånd 8100

Morsø 8100

Material:	8x4mm Glasbånd m. tape	
Weight:	0,37 kg	
Model no.		
Drawingtype:	Emnetegning	
Location of file:	U:\UDV\Tegninger\8100\8100-130 Glasbånd.SLDPRT	

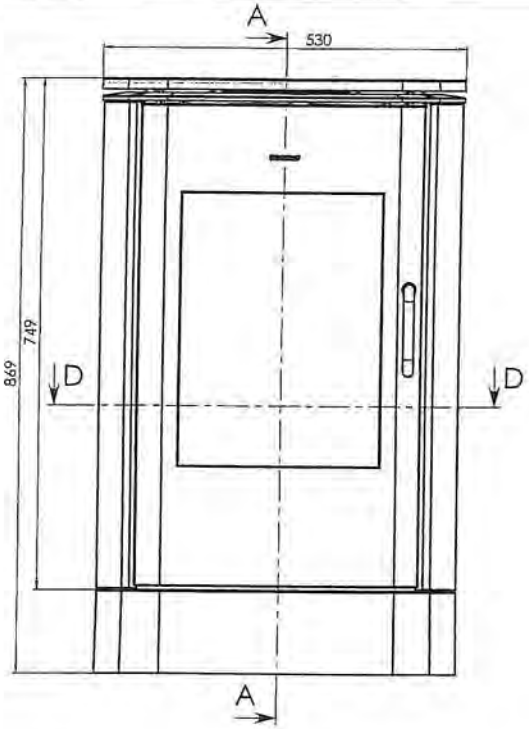
Construction:	KDU	28.10.05
Released:		
Format:	A4	
Scale:	1:2.5	
Itemno.:	79074200	

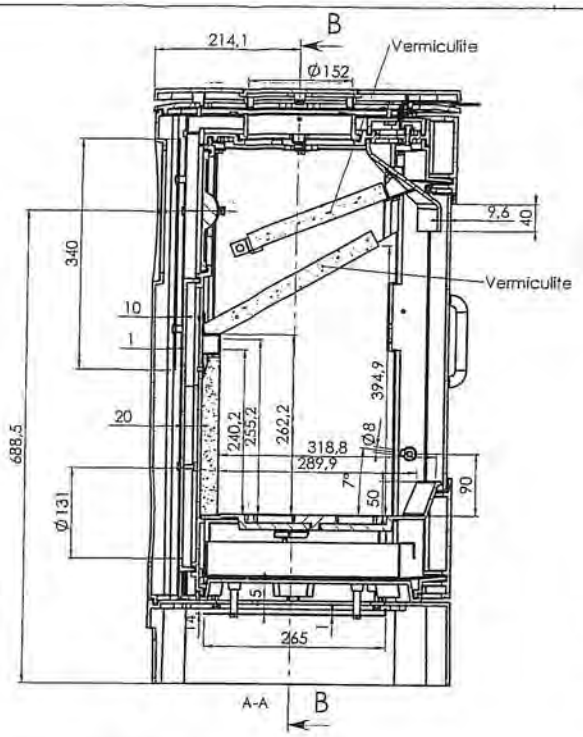
morsø
By appointment to the Royal Danish Court

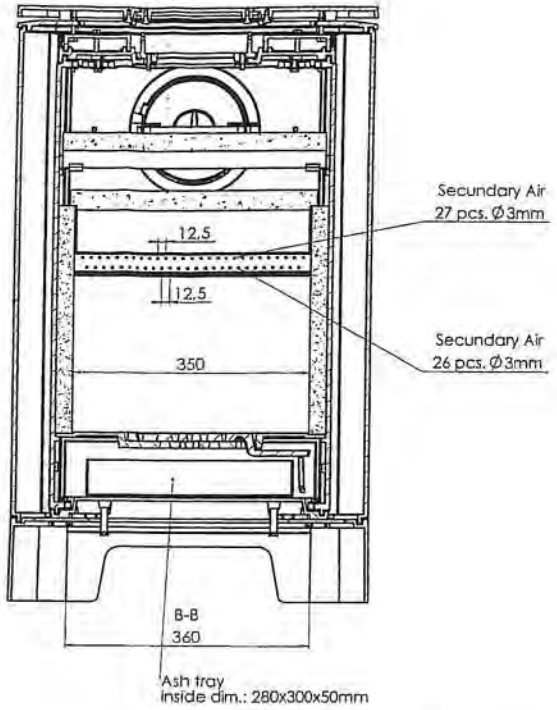
Drawing no.:

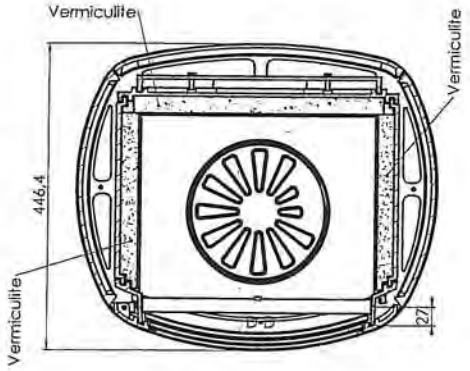
8100-130 a

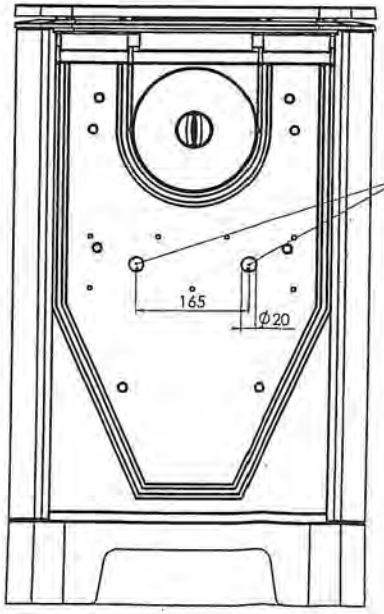
Date of print: 28-10-2005

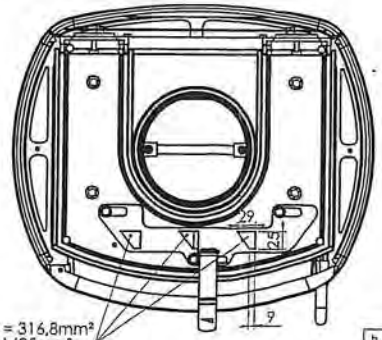




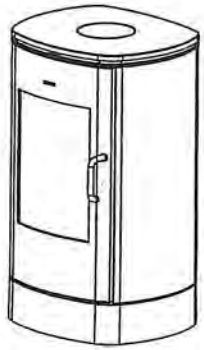








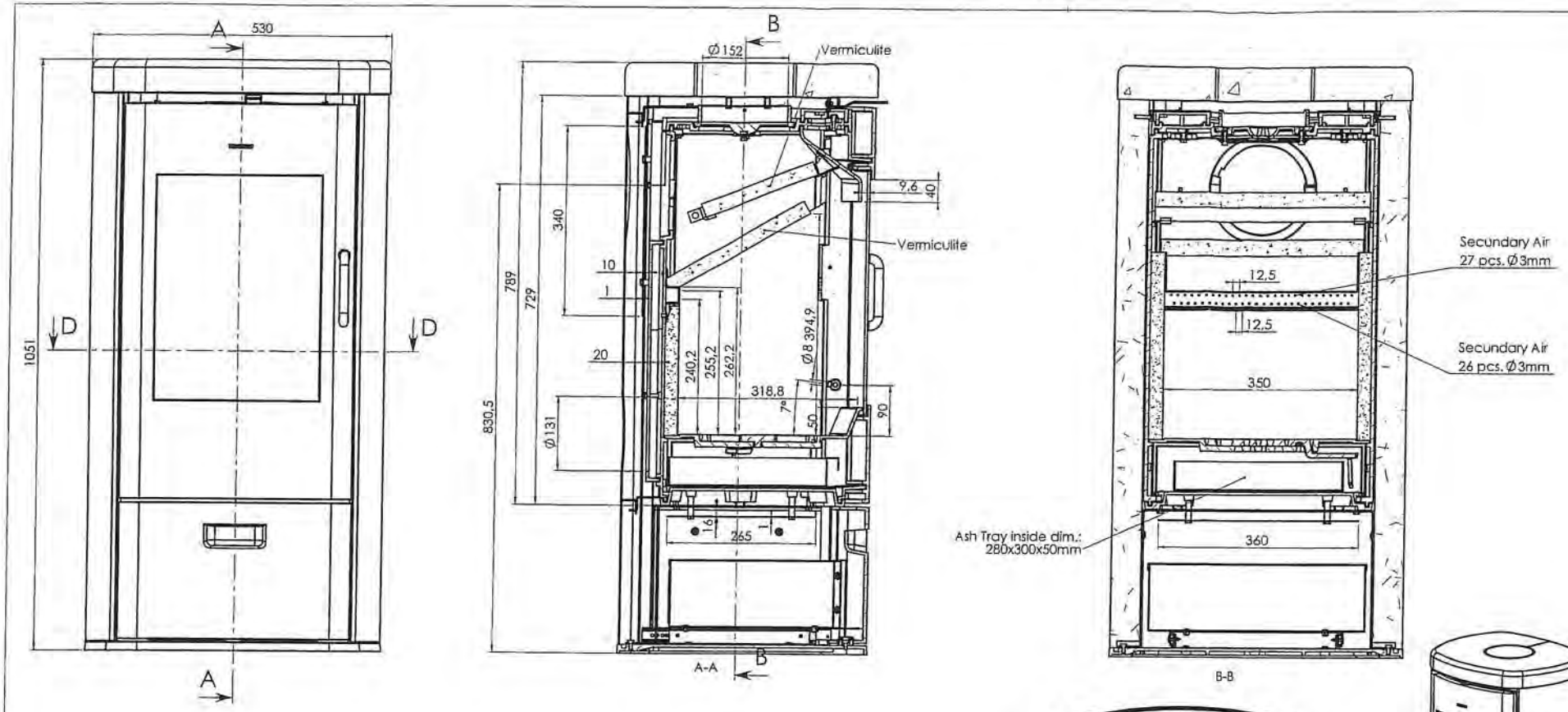
Primary Air:
Min.: 3x105,6mm² = 316,8mm²
Max.: 3x475mm²=1425mm²



Rev.	Revisions	Sign.	Date
b	Added pilotair and reduced primary air.	KDU	24.10.05

Dim. without indication of margin acc. to ISO Norm No.: 8992-CT9	Title: App. Drawing 8140 NA	Construction:	KDU 24.05.05
Material:		Released:	
Weight: -		Format:	A2
Model no.: -	Morsø 8100	Scale:	1:5
Drawingtype: Approval Drawing		Remark:	
Location of file:	morsø	Drawing no.:	8100-102 b

Date of print: 26-10-2005



Rev.	Revisions	Sign:	Date:
b	Added pilotair and reduced primary air.	KDU	25.10.05

Dim. without indication of margin acc. to ISO Norm No.: 8062 CT9	Title: Approval Draw. 8150 NA	Construction: KDU	25.05.05
Material:		Released:	
Weight: -		Format:	A2
Model no.: -	Morsø 8100	Scale:	1:5
Drawing type: Approval Drawing		Item no.:	
Location of file:	morsø	Drawing no.:	8100-105 b

Date of print: 26-10-2005

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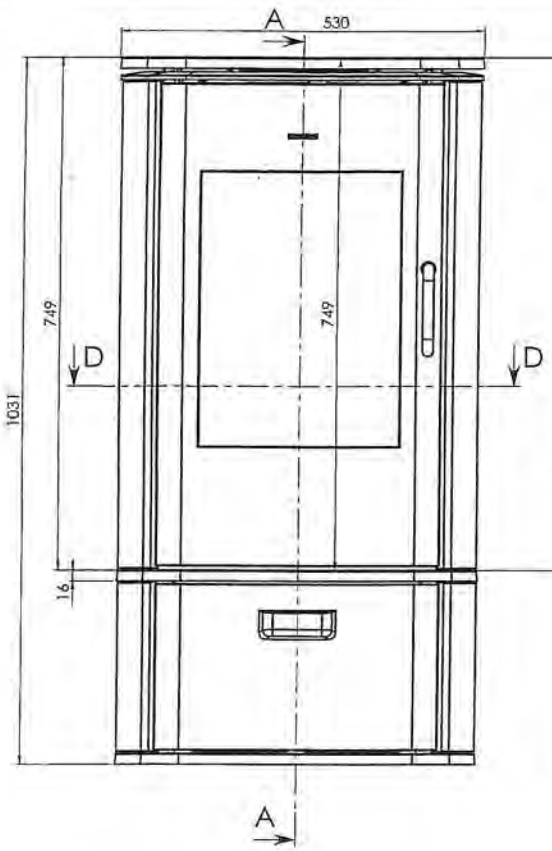
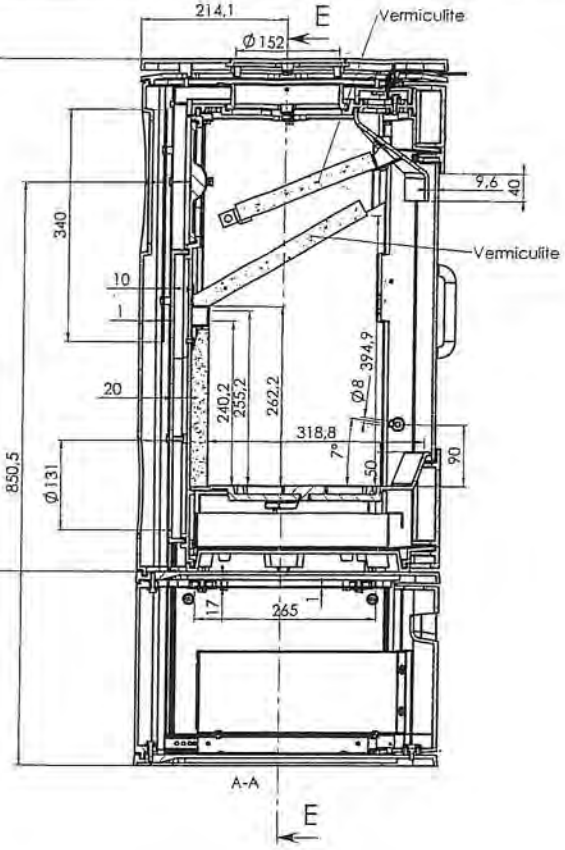
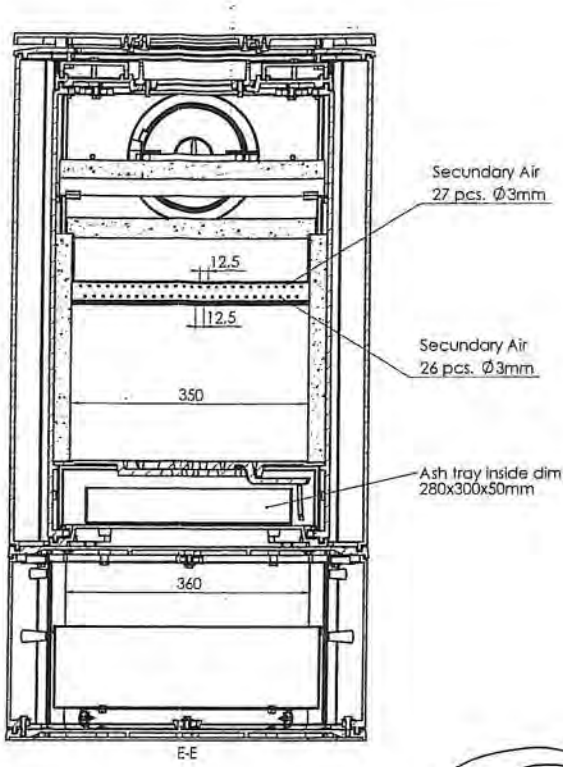
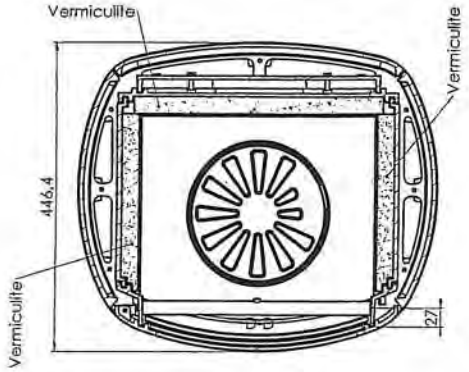
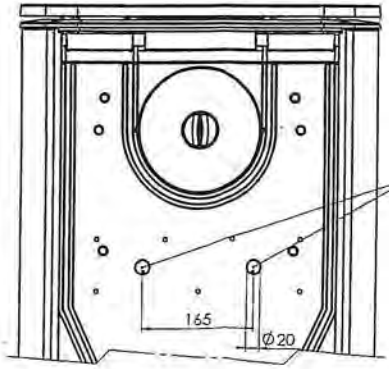
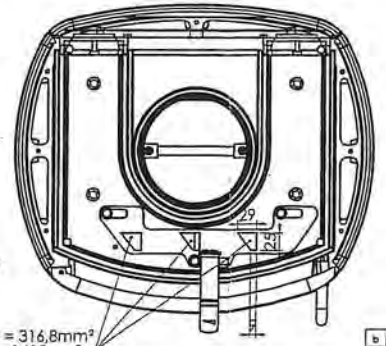


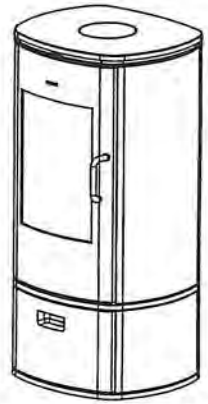












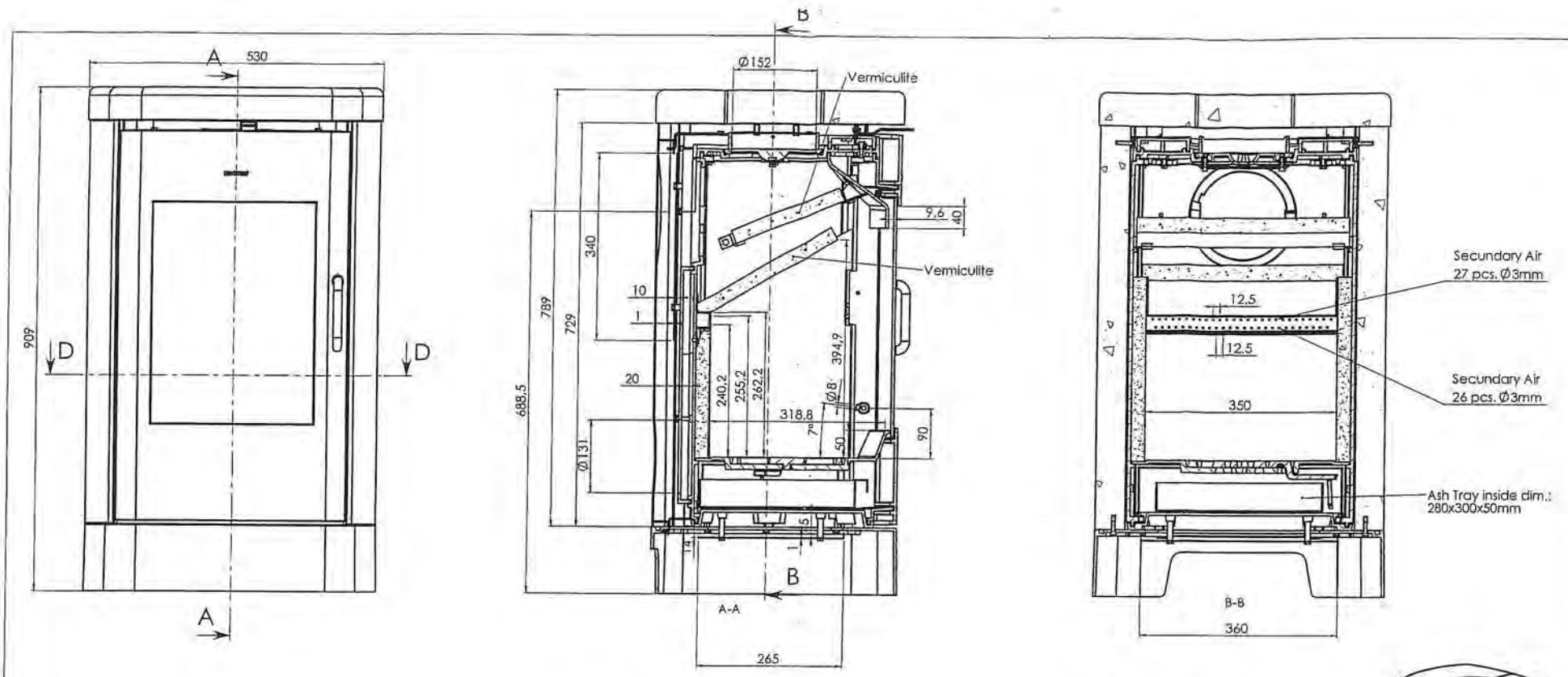
b	Added pilotair and reduced primary air.		KDU	24.10.05
Rev.	Revisions		Sign.:	Date:
	Title:	Construction:	KDU	24.05.05
Dim. without indication of margin acc. to ISO from No.: 6082 CT3	Approval Draw. 8142 NA	Released:		
Material:		Format:	A2	
Weight:	-	Scale:	1:5	
Model no.	-	Item no.:		
Drawingtype:	Approval Drawing	Drawing no.:	8100-103 b	
Location of file:				

Morsø 8100

morsø

Date of print: 26-10-2005

3-77 of 3-103

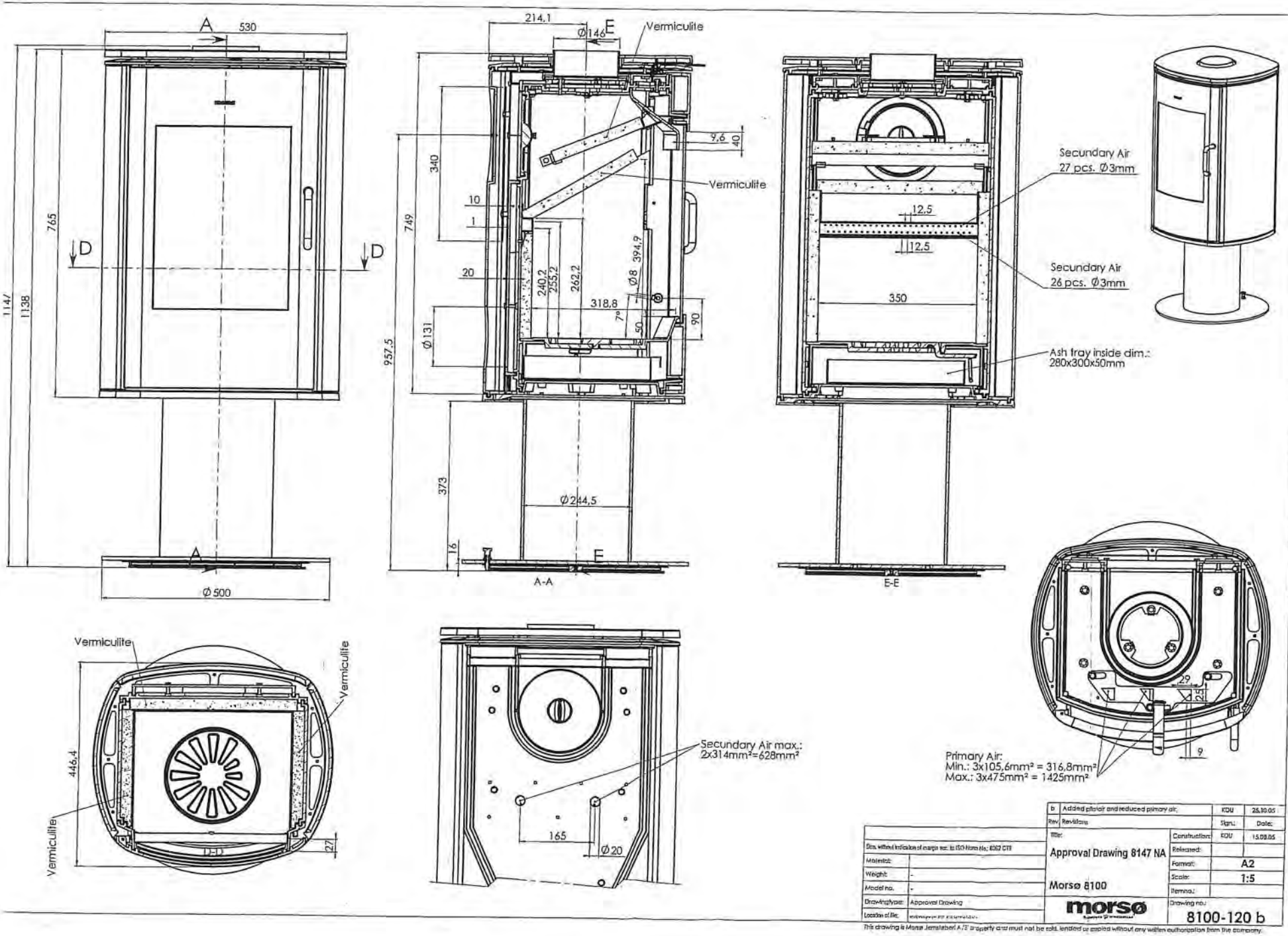


Rev.	Revisions	Sign.:	Date:
b	Added pilotair and reduced primary air.	KDU	25.10.05

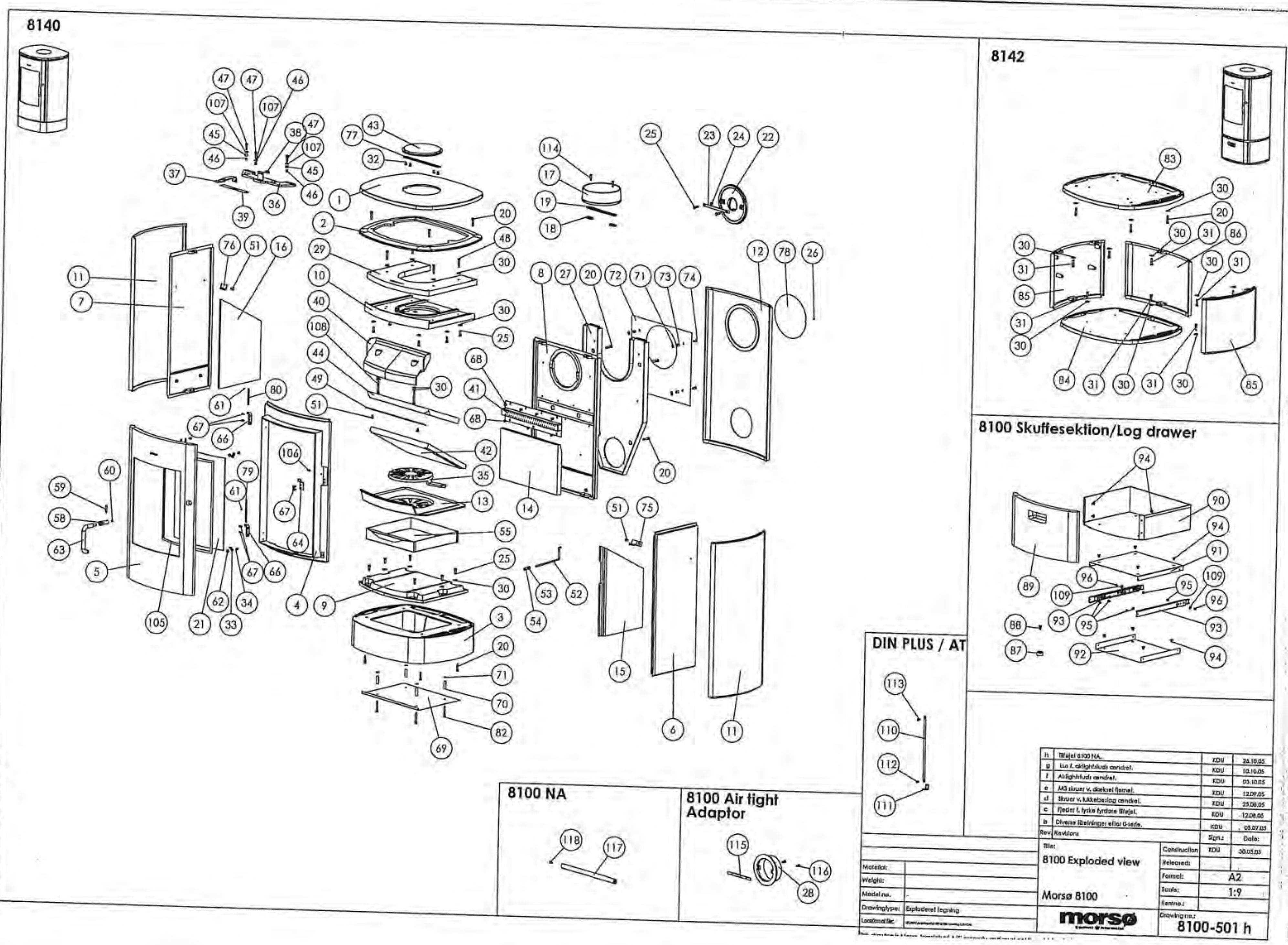
Dim. without indication of tolerance acc. to ISO Norm No.: 8062 CT9	Title: Approval Drawing 8151 NA	Construction: KDU	25.05.05
Material:		Released:	
Weight: -		Format:	A2
Model no. -	Morsø 8100	Scale:	1:5
Drawingtype: Approval Drawing	morsø	Item no.:	
Location of file:		Drawing no.:	8100-106 b

Date of print: 26-10-2005

3-79 of 8-103

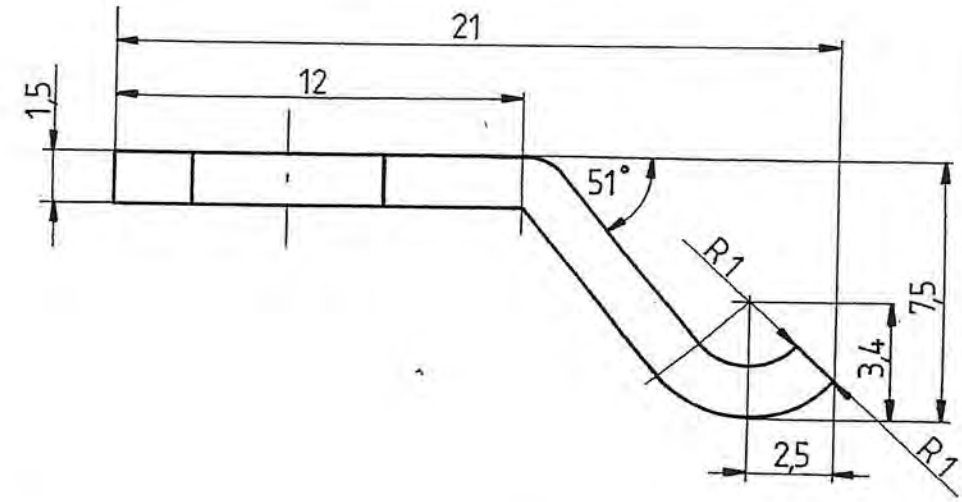


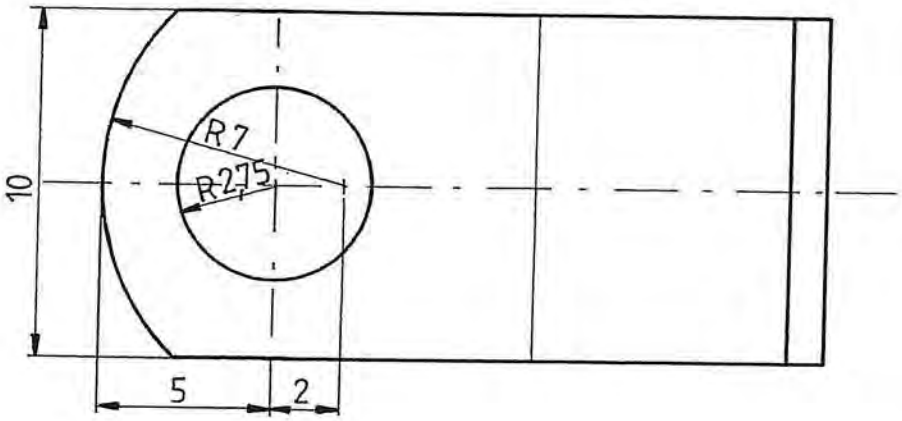
b	Added pitotair and reduced primary air.		KDU	25.10.05
Rev.	Revisions		Sign.:	Date:
Dim. without indication of margin acc. to ISO-Norm No: 8062 CT8	Title: Approval Drawing 8147 NA	Constructions:	KDU	15.08.05
		Released:		
Material:		Format:	A2	
Weight: -	Morsø 8100	Scale:	1:5	
Model no. -		Remno.:		
Drawingtype: Approval Drawing	morsø	Drawing no.:	8100-120 b	
Location of file:				


8140
8142
8100 Skuffesektion/Log drawer
DIN PLUS / AT
8100 NA
8100 Air tight Adaptor
h Tilføjet 8100 NA. KDU 26.10.05
g Lus f. airlightstuds ændret. KDU 10.10.05
f Airlightstuds ændret. KDU 03.10.05
e M3 skruer v. dæksel fjernet. KDU 12.09.05
d Skruer v. lukkebeslag ændret. KDU 25.08.05
c Fjeder f. tyske fyrdøre tilføjet. KDU 12.08.05
b Diverse tilretninger efter 0-serie. KDU 05.07.05
Rev. Revision Sign.: Date:
Title:
8100 Exploded view
Morsø 8100
Construction KDU 30.05.05
Released:
Format: A2
Scale: 1:9
Itemno.:
Drawing no.:
8100-501 h
Material:
Weight:
Model no. -
Drawingtype: Eksplodering tegning
Location of file:

3-81 of 8-103

Dato	Kg. 10 stk.





NB! Findes som solidworkspart
1124 / 1124-29 glasclips.prt.
24/7-00 / KOU.

edbnr. 790743

LEVERANDØR TIL
DET KGL. DANSKE HOF
morsø
AKTIESELSKABET
N. A. CHRISTENSEN & CO
7900 NYKØBING MORS
TLF. 97 72 13 00

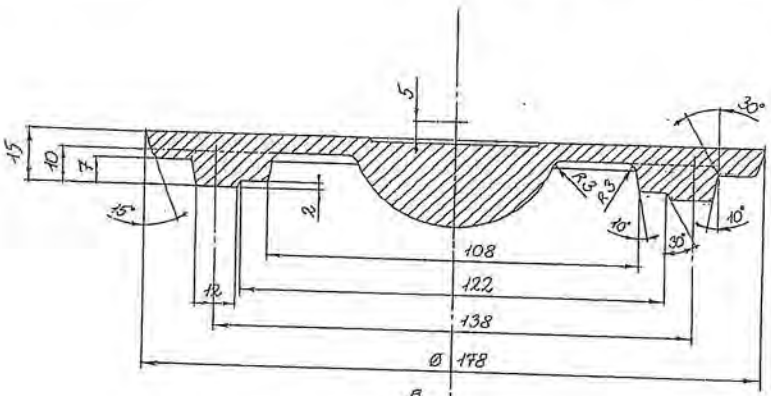
GLASKLIPS.

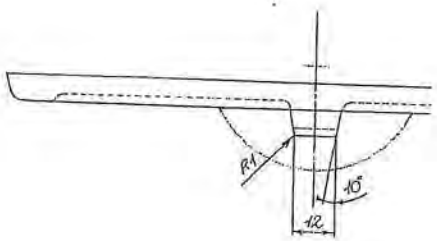
1,5mm rf.plade

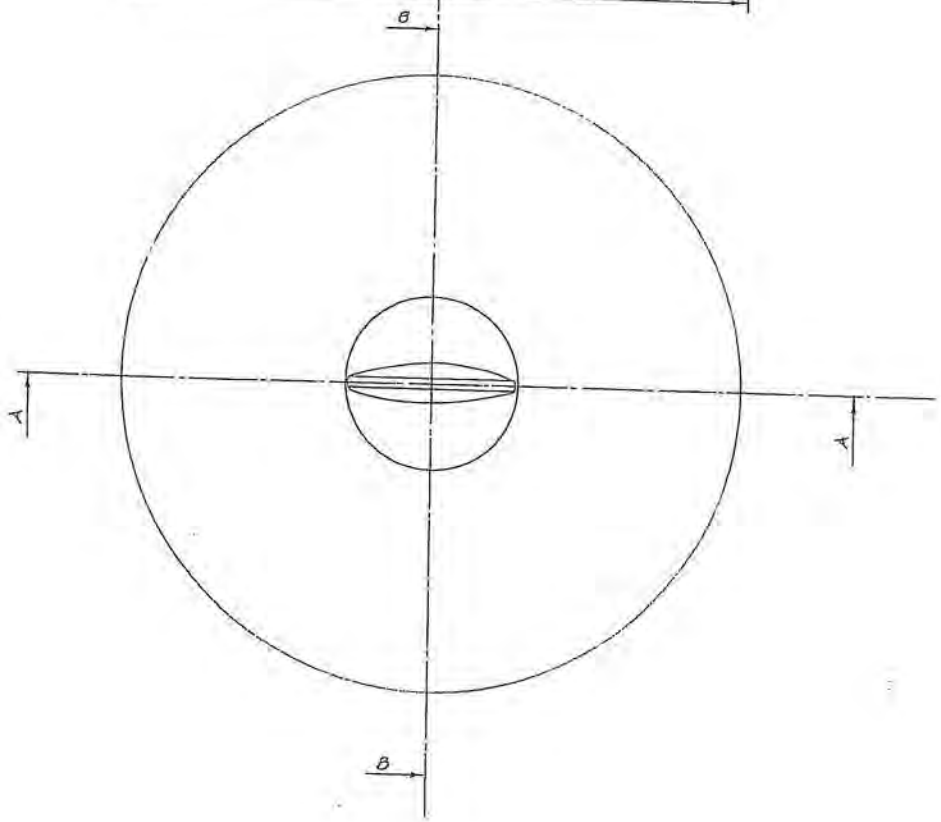
werkstoff nr. 1.4301

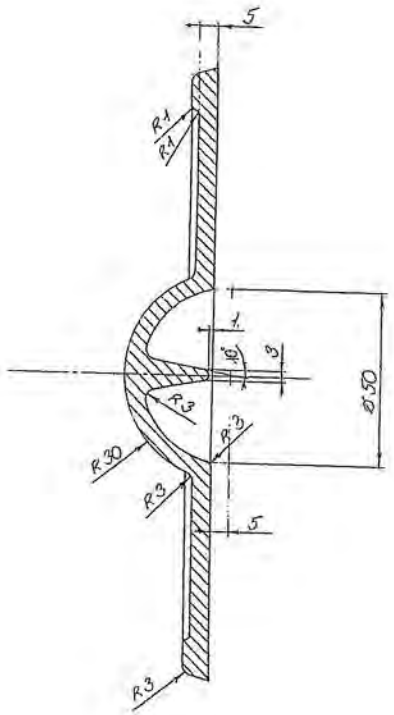
DATO	SIGN.
23-2-93	AaGJ
MÅL: 5:1	ÆNDRET: 5-12-84
	MODELNR.
TEGNINGSNR. 1124-29-4	

RESTO 5526 - MI 8080







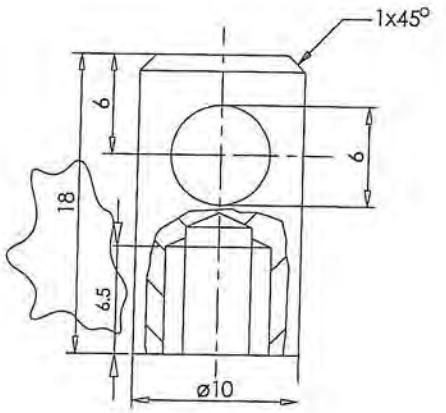


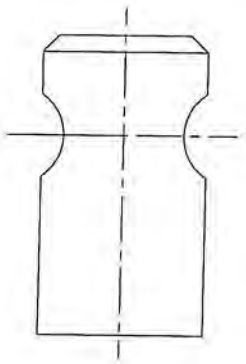
Solidpart

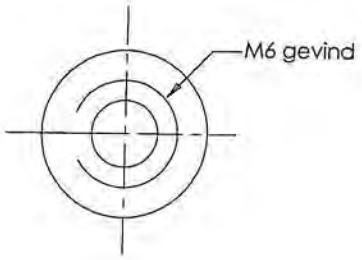
LEVERANDØR TIL DET KGL. DANSKE HOF morsø AKTIESELSKABET H. A. CHRISTENSEN & CO. DK-7700 THISTED MORSØ TLF. 97-72 13 00	1,0	DATO 12 MAJ 1987	SIGN. K.
	DÆKSEL MORSØ 1126	MÅL 1:1	ÆNDRET
		MODELNR. 2610	
		TEGNINGSNR. 1126-16-2	

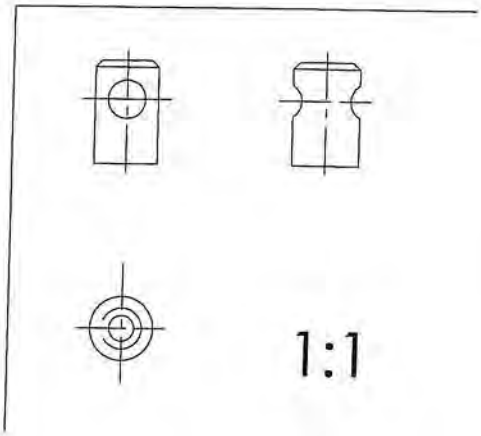
3-83 + 3-103

2,5:1





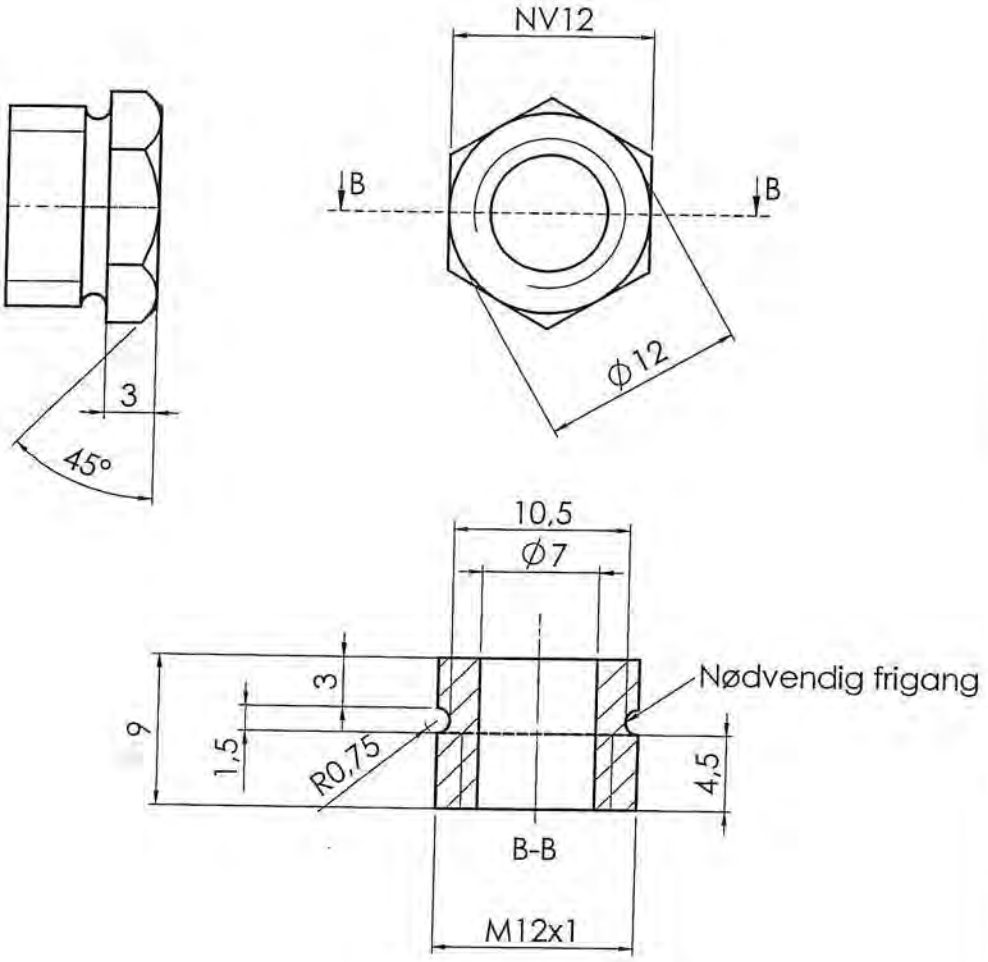




1:1

Matr.: Automatstål

Rev.	Revision	Sign.	Dato	Titel:	Sign.:	Dato:
b	Gamdrup TegneTeknik	HCH	April 96	Knop til rystestang 1126	ZZ	XXXXX
c	Tilføjet tegn.nr.	KD	20.12.96		Tegn.form.: A4	Målforhold 1:1/2.5:1
d	Varenr. ændret fra 752620	KD	01.07.99	Filnavn: 1126-26	Varenummer: 752619	
e	Længdemål ændret	KDU	10.08.99	morsø Jernstøberi A/S	Tegningsnummer: 1126-26 e	



Rev.	Revisionstekst:		Sign.:	Dato:
a	Emne optegning i SolidWorks		KDU	02.07.01

Materiale:	Messing			Konstr.:	N.Aa 28.07.87
Vægt:	0,006 kg.	Bearbejdes:	Drejes	Frigivet:	
Overfladebeh.:	Ubehandlet		- m²	Tegn.format:	A4
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m			Målforhold:	2.5:1
Ruhedstolerance:				Varenr.:	752621
Værktøjsnr.:	-			Tegningsnr.:	1126-27 a
Tegningstype:	Emnetegning				

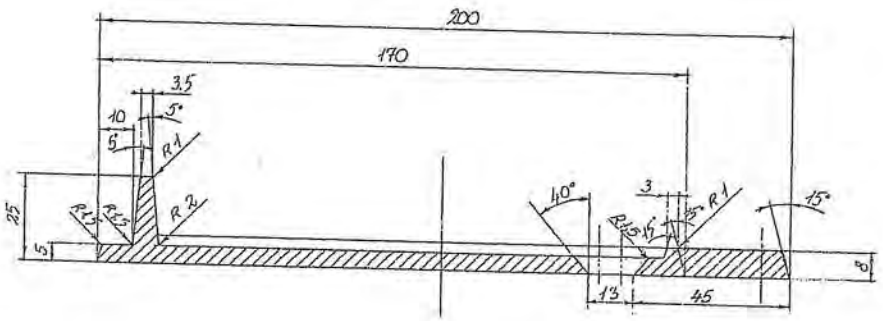
Titel: **Bøsning for rystestang**

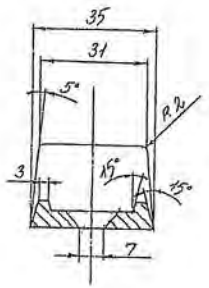
Morsø 1126

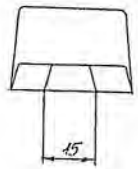
morsø

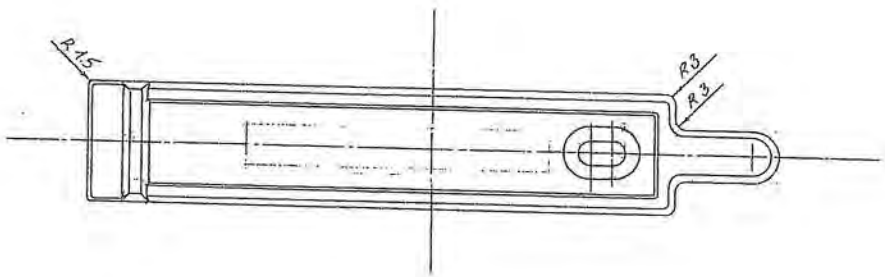
1126-27 messingbøsning - Sheet1

3-85 af 3-103







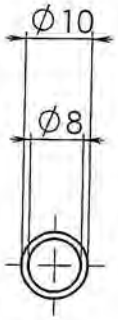


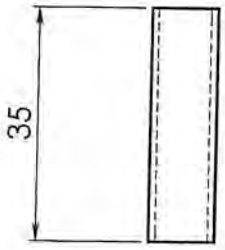
LEVERANDØR TIL DET KGL. DANSKE HOF
morsø
AKTIESELSKABET H.A. CHRISTENSEN & CO.
DK-7900 NYKØBING MORS
TLF. 97-721390

MORSØ 1126
RYSTEHÅNDTAG

DATO 30 JUNI 1987	SIGN. K
MÅL 1:1	ÆNDRET 7/10-26 11.42. + Rul
	MODELNR.
TEGNINGSNR. 1126-42-2.	

3-810 + 8-905

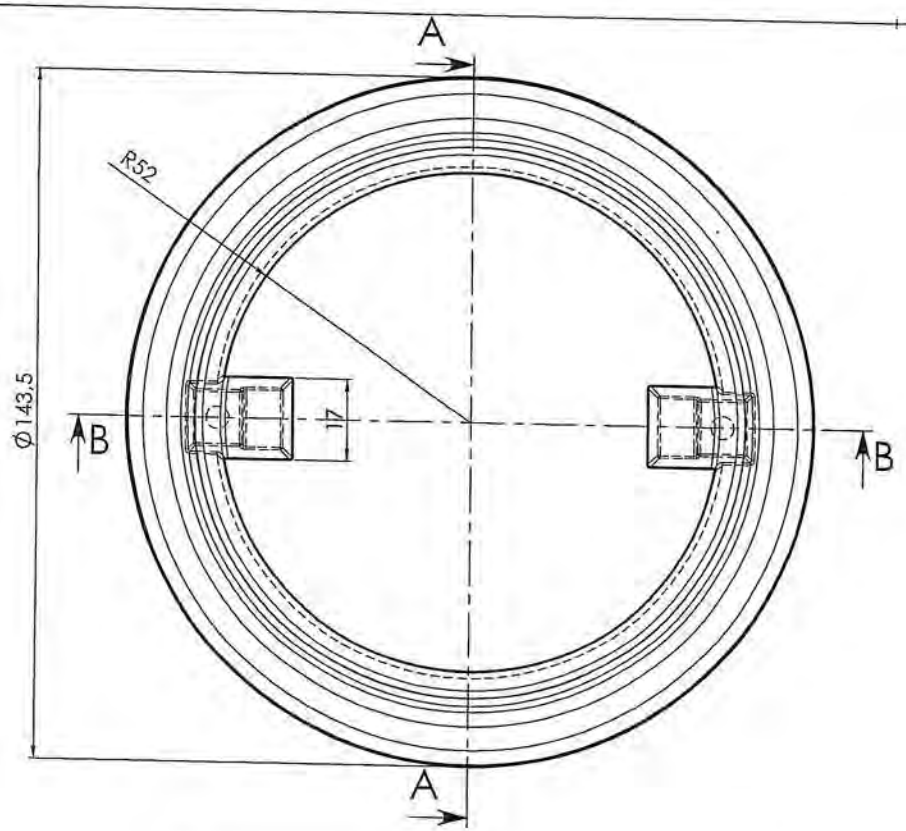


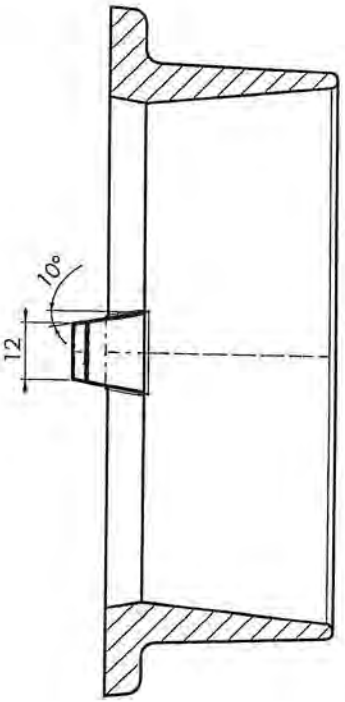


Rev.	Revisions	Sign.:	Date:

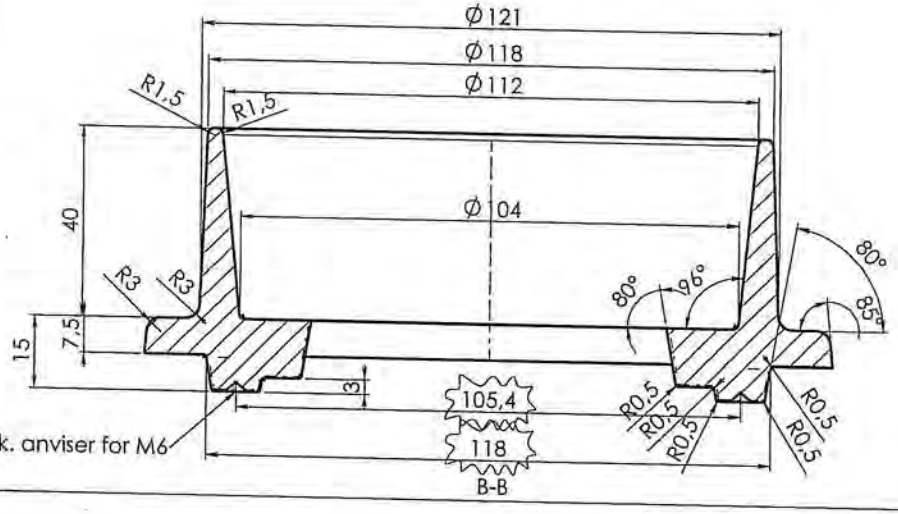
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m		Title: **Afstandsrør ø10x1 L=35**	Construction:	RSV 21.11.03
Material:	galv.hydraulikrør	**ø10x1 L=35**	Released:	
Weight:	0,01 kg	**Morsø 1126**	Format:	A4
Model no.	-		Scale:	1:1
Drawingtype:	Emnetegning	morsø By appointment to HM the Royal Danish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

Date of print: 27-10-2005





A-A

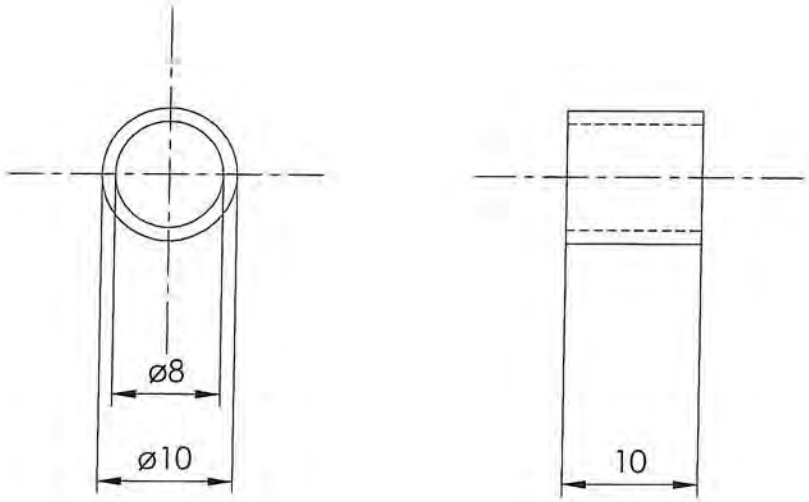


c	Ændret mål for nokker og anviser	RSV	24.08.04
b	Ændret til SolidWorks.	RSV	15.06.04
Rev.	Revisions	Sign.:	Date:

Anviser efter instruktion: 7.04.02 Boreanviser	
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	
Material:	Støbejern GG 15
Weight:	1,04 kg
Model no.	1419
Drawingtype:	Støbetegning
Location of file:	

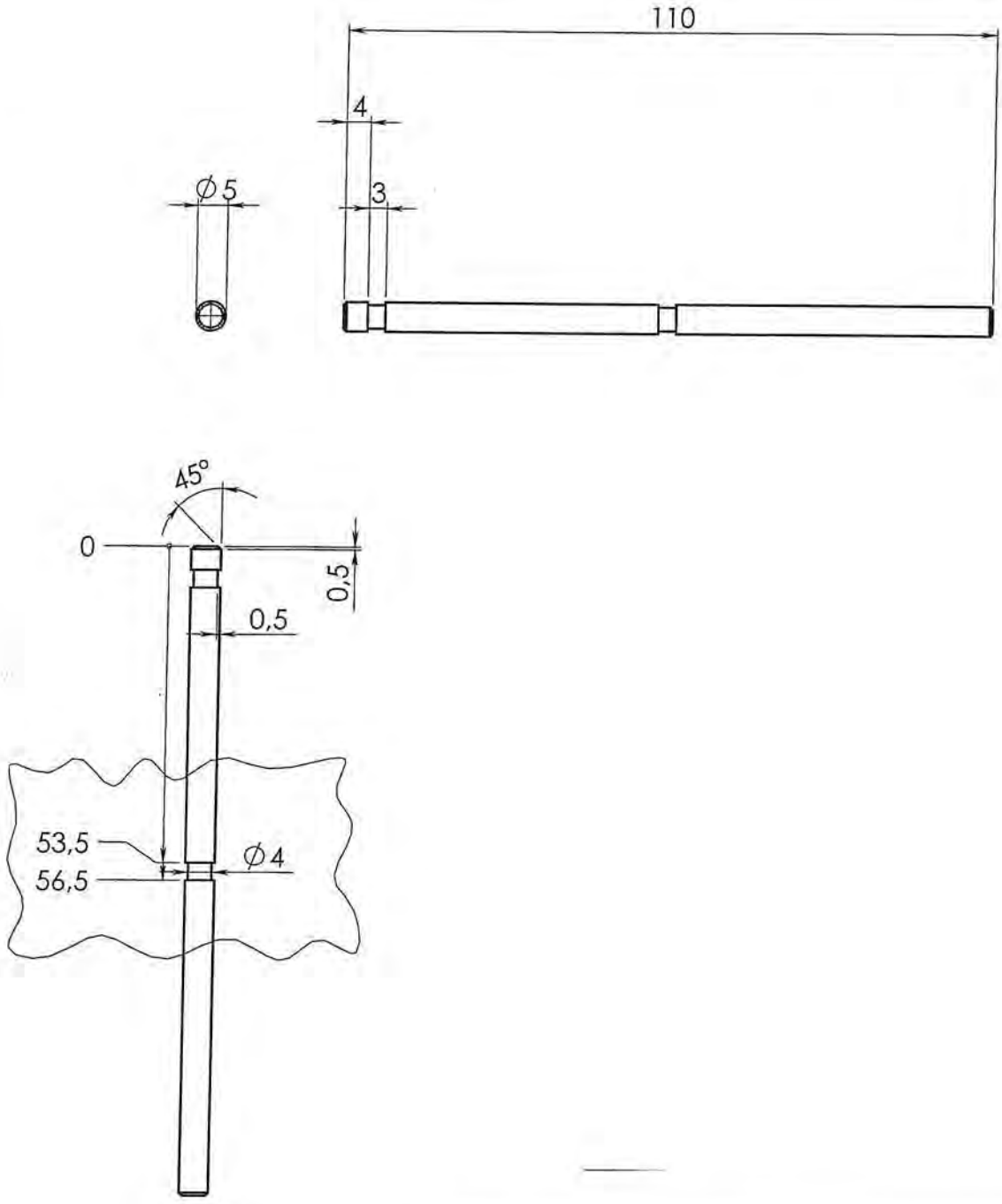
Title:		Construction:	RSV 15.06.04
Røgtud DIN		Released:	
Ø121		Format:	A3
Morsø 1400		Scale:	1:1
		Itemno.:	341419
morsø		Drawing no.:	1400-87 c

3-88 af 3-103



Matr:10x1 Hydraulikrør galv. varenr.712602

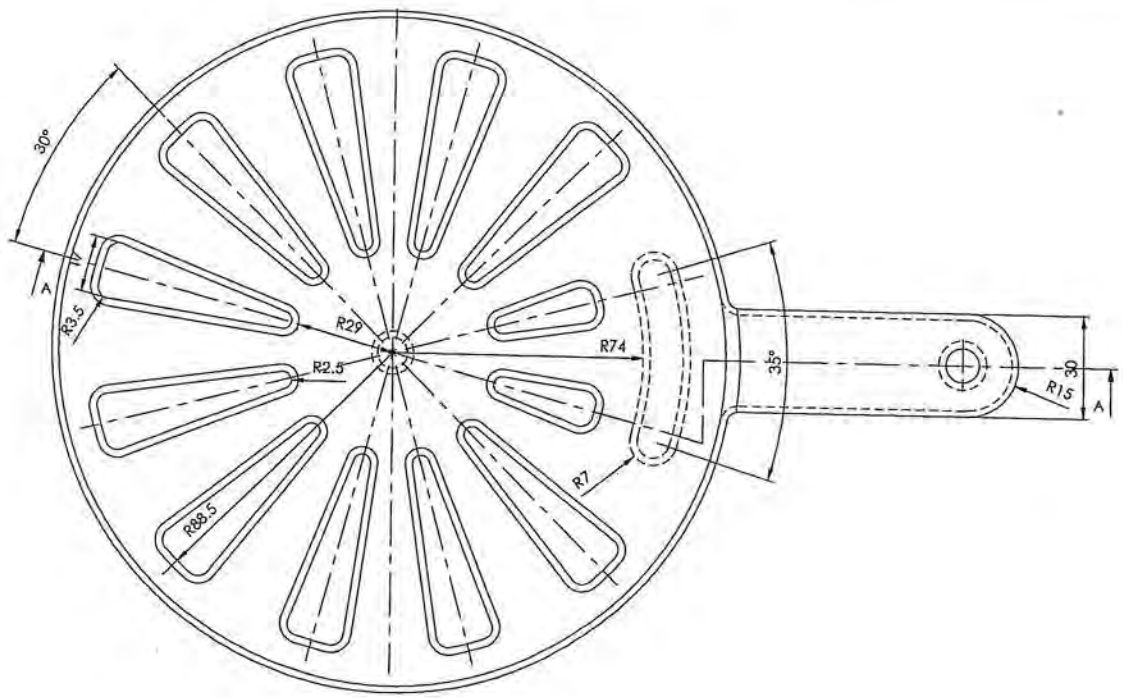
Titel: Afstandsrør ø10x1 L=10	Sign.: RS	Dato: 970113	Revision	Sign.	Dato
	Tegn.form.: A4	Målforhold 2:1			
Tegningsnummer: 1400-300-4	Varenummer: 541439				
morso / Jernstøberi A/S	Filnavn: 1400-300				

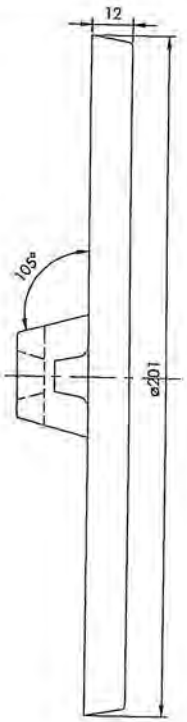


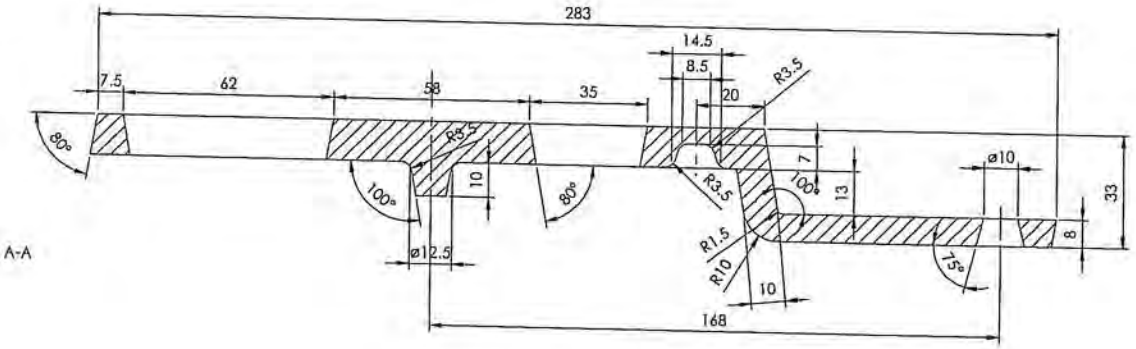
Rev.	Revisions	Sign.:	Date:
c	Tilføjet rille midtfor til Morsø 8100.	KDU	11.05.05
b	Ændret mål	RSV	25.06.03

Material:	Automatstål	Title: Hængselsstift ø5x110	Construction: RSV 17.03.03
Weight:	0,02 kg		Released: RSV 17.03.03
Model no.	-	Morsø 2040	Format: A4
Drawingtype:	Emnetegning		Scale: 1:1
Location of file:	L:\LDV\tegninger\standardbibliotek\Hængselstift5LDP.tif	morsø By appointment to HM The King of Denmark's Court	Itemno.: 54501800
			Drawing no.: 2000-186 c

Date of print: 27-10-2005







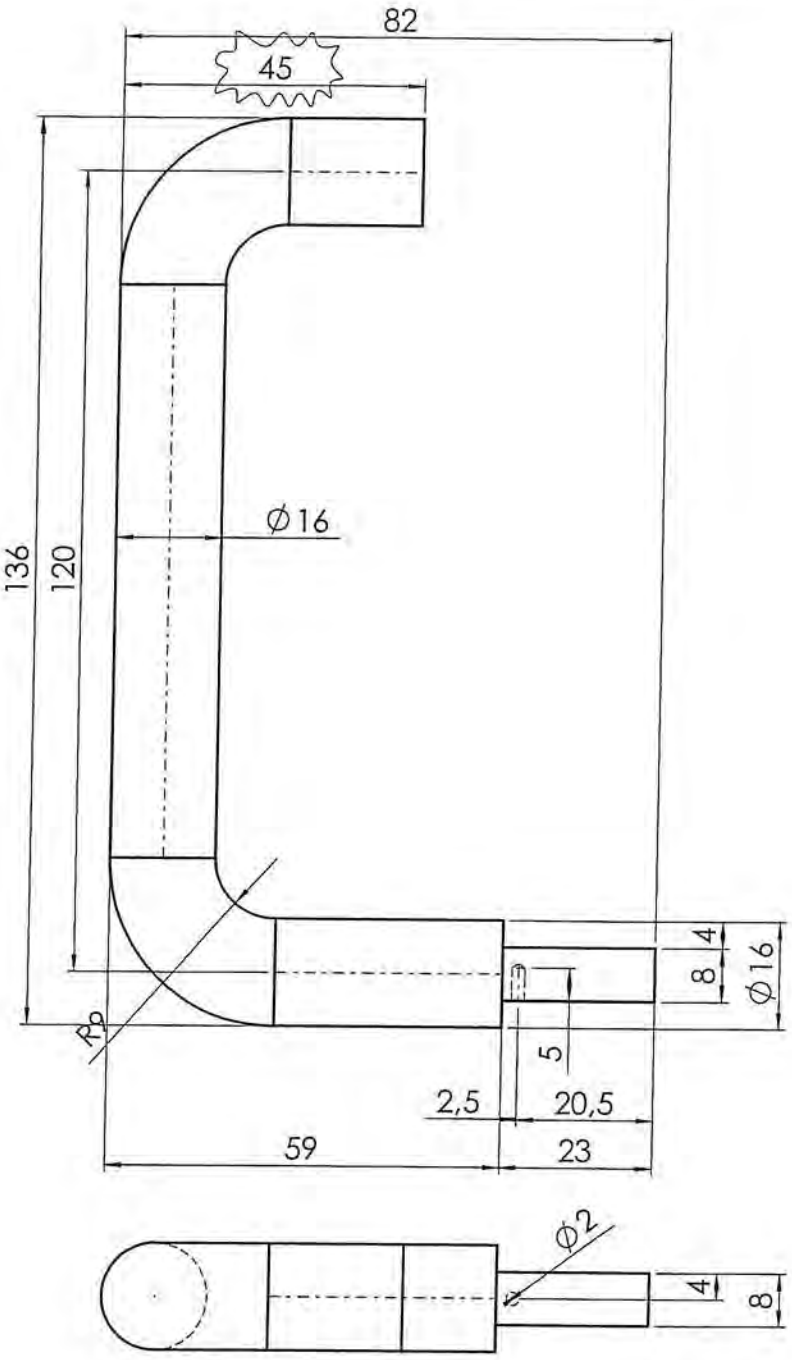
Snit A-A

Ikke anglvne radier R1

Rev.	Revision	Sign.	Dato
b	Støtteliv på slidehuller ændret	RSV	22.03.99

Modelnr.: 1828	Matr.: GG15+CH	Vægt3.85 kg.
Titel: Rist	Sign.: AaGJ	Dato: 09.06.93
2100/4500/4600/ 5000/6000	Tegn.form.: A2	Målforhold 1:1
Filnavn: 2100-66	Varenummer: 44182800	
morsø	Tegningsnummer: 2100-66 b	

3-91 af 3-103



c	Ændret mål	RSV	29.05.2001
b	Ændret mål	RSV	27.02.2001
Rev.	Revisionstekst:	Sign.:	Dato:

Materiale:	Rustfast stål		
Vægt:	317	Bearbejdes:	Bores
Overfladebeh.:			m²
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m		
Ruhedstolerance:			
Værktøjsnr.:			
Tegningstype:	Emnetegning		

Titel:

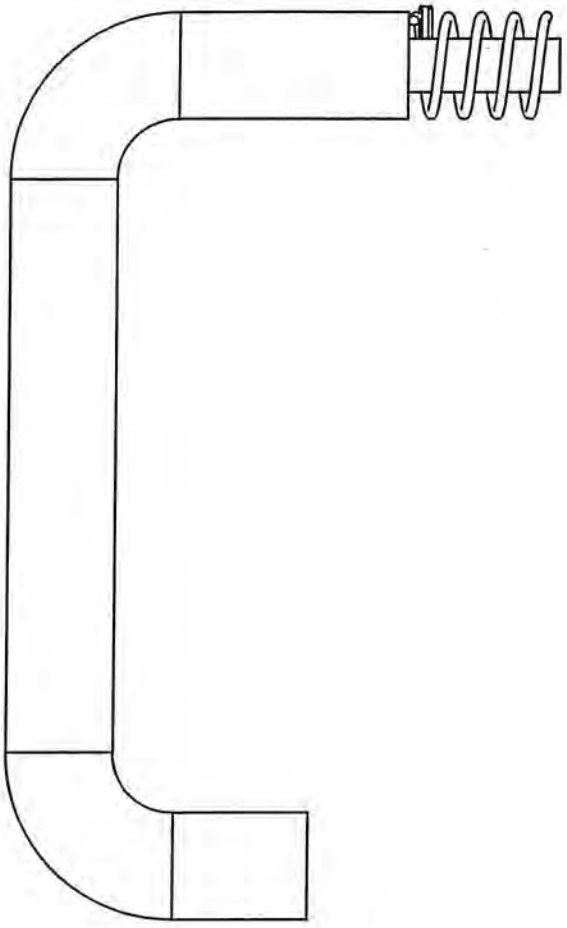
Håndtag 2110 USA

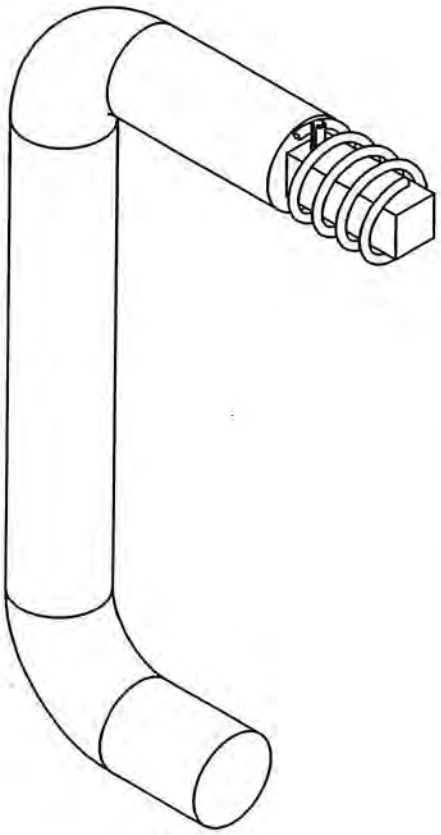
Morsø 2100

morsø

Konstr.:	RSV	22.01.2001	
Frigivet:	RSV	22.01.2001	
Tegn.format:	A4		
Målforhold:	1:1		
Varenr.:	75262400		
Tegningsnr.:	2100-158 c		

2100-158 Håndtag 2110 USA - Sheet1



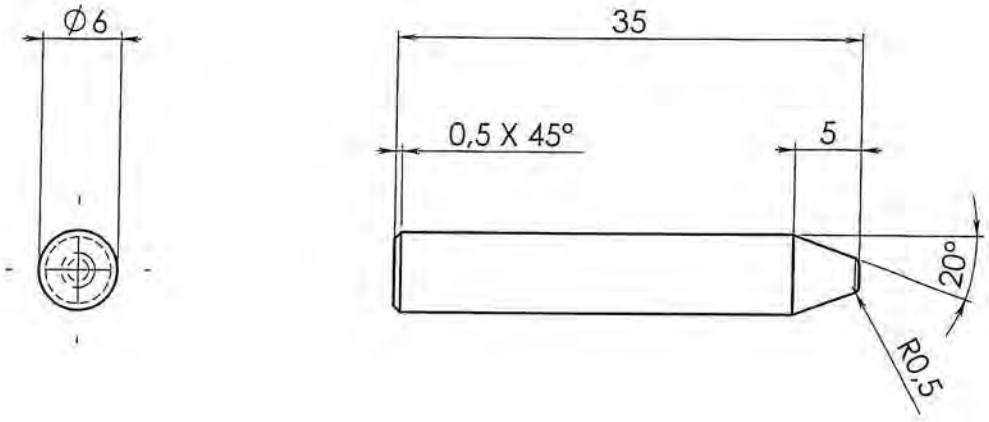


Rev.	Revisionstekst:	Sign.:	Dato:

Materiale:		Titel:	Konstr.:	RSV	26.01.2001
Vægt:	kg. Bearbejdes:	**Håndtag komplet USA**	Frigivet:		
Overfladebeh.:	m²		Tegn.format:	A4	
Måltolerance:	Mål uden toleranceangivelse		Målforhold:	1:1	
Ruhedstolerance:		**Morsø 2100**	Varenr.:		
Værktøjsnr.:		morsø By appointment to the Royal Danish Court	Tegningsnr.:	**2100-159 a**	
Tegningstype:	Samlingstegning				

2100-159 Håndtag komplet USA - Sheet1

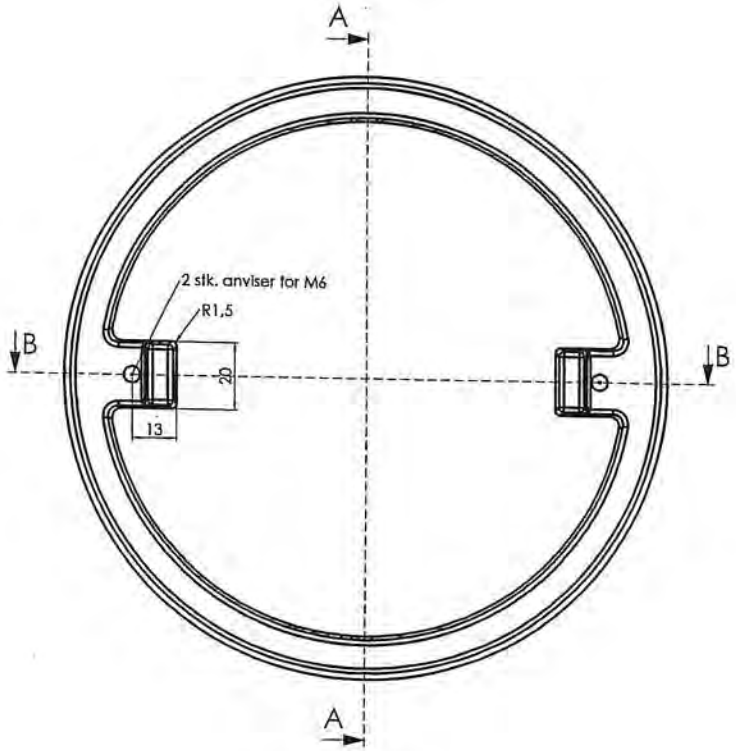
3-93 of 3-103

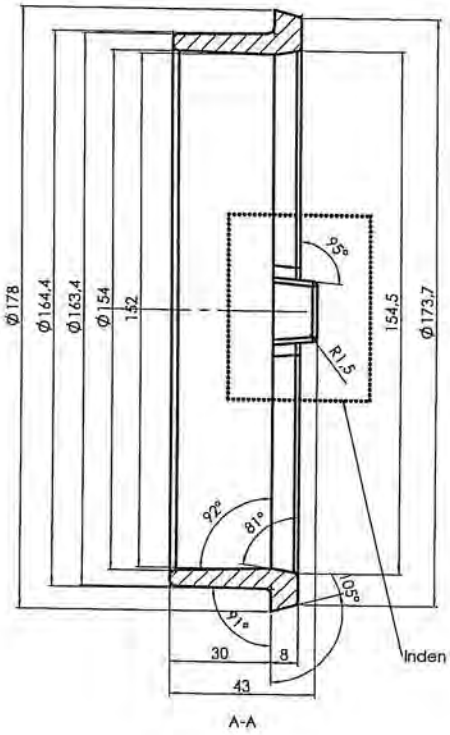


Rev.	Revisions	Sign.:	Date:

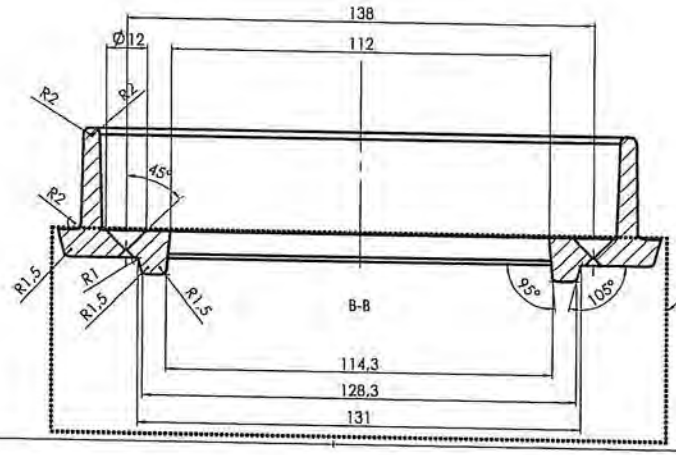
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m		Title: ø6x45 Hængselsstift	Construction:	RSV 26.01.04
Material:	Rustfri stål		Released:	
Weight:	0,05 kg		Format:	A4
Model no.	-	Morsø 2100	Scale:	2:1
Drawingtype:	Emnetegning		Itemno.:	541808
Location of file:	U:\udv\Tegninger\ulandsbibliotek\a6 Hængselstift.SLDPRT	morsø By appointment to the Royal Danish Court	Drawing no.:	2100-174 a

Date of print: 27-10-2005



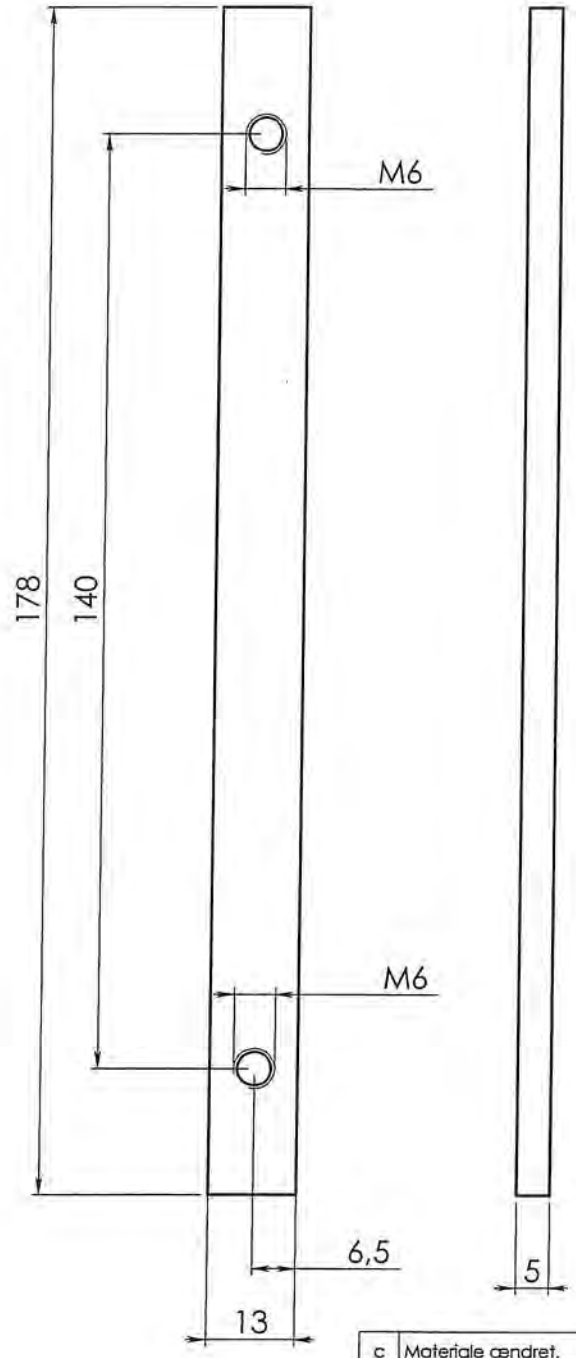


Inden for ramme identisk med model 2627



Inden for ramme identisk med model 2627

Materiale:	GG15			Rev.	Revisionstekst:	Sign.:	Dato:
Vægt:	0,975 kg	Beabejder:		Tilst:	Røgtud USA	Konstr.: RSV	13.12.2000
Overfladebeh.:			m²			Frigivet: RSV	21.06.2001
Måltolerance:	Mål uden toleranceangivelse ISO-norm nr. 8062 CT8					Tegn.format:	A2
Ruhedstolerance:					Morsø 3400	Målforhold:	1:1
Varitetsnr.:	Modelnr.: 3441					Varenr.:	34344100
Tegningstype:	Støbetegning				morsø	Tegningsnr.:	3400-97 a



Rev.	Revisions	Sign.:	Date:
c	Materiale ændret.	KDU	16.09.05
b	Kuglespærre ændret udseende.	KDU	18.08.05

Material:	Båndstål sort, varmt valset	Construction:	RS 14.02.97
Weight:	0,1 kg	Released:	
Model no.	-	Format:	A4
Drawingtype:	Emnetegning	Scale:	1:1
Location of file:	U:\UDVI\tegninger\4500\Tegning\4500-51 kuglespærre 4500.SLDPRT	Itemno.:	544541

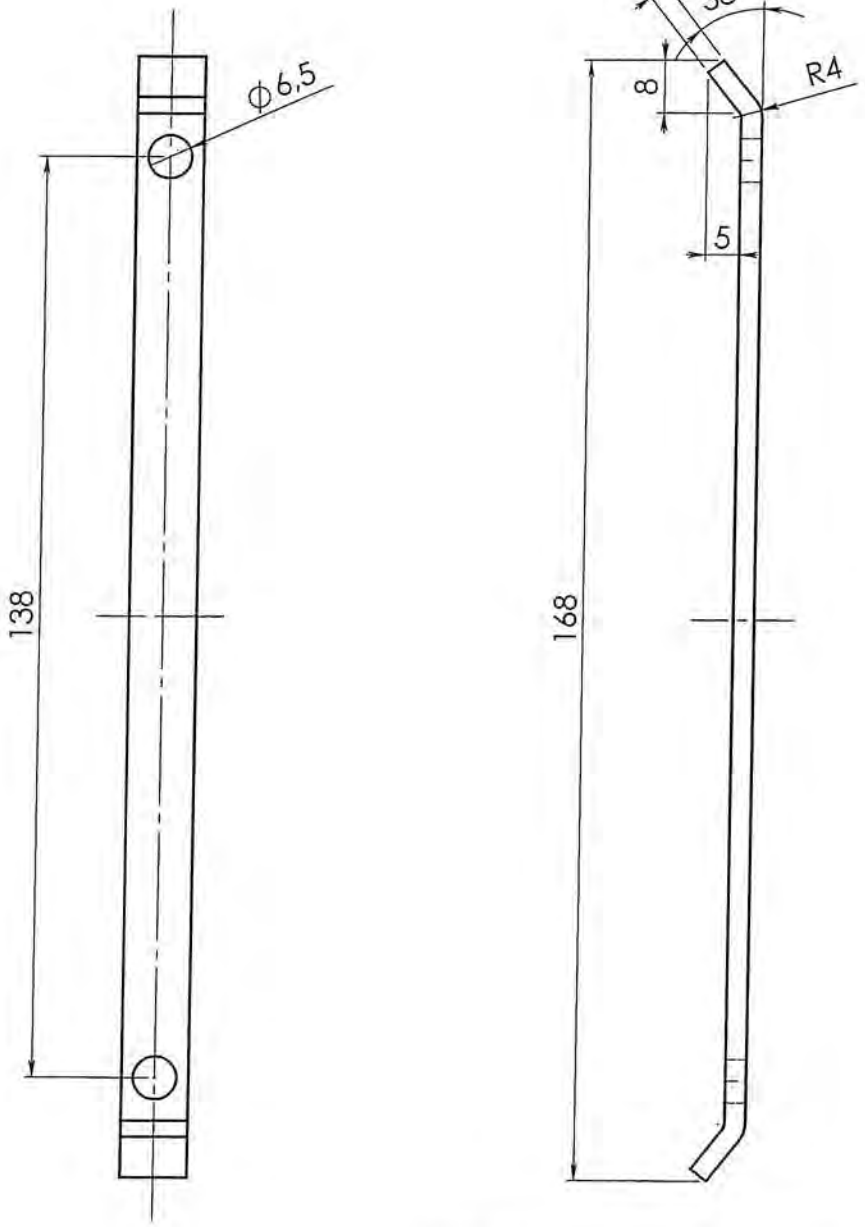
Title: **Kuglespærre 4500**

Morsø 4500

morsø — By appointment to the Royal Danish Court

Drawing no.: **4500-51 c**

Date of print: 27-10-2005



Rev.	Revisions	Sign.:	Date:
f	Fjernet gevindhuller og bukket begge ender.	RSV	05.09.05
e	Ændret mål.	RSV	14.12.2001
d	Ændret mål.	RSV	05.03.1999
c	Varenr. + mål ændret.	RSV.	14.02.1997
b	-	KAA.	26.09.1995

Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	
Material:	Båndstål sort, varmt valset
Weight:	0,04 kg
Model no.	
Drawingtype:	Emnetegning
Location of file:	U:\ucd\Tegninger\5000\TEGNING\5000-63 bøjle til røgdæksel.SLDPRT

Date of print: 27-10-2005

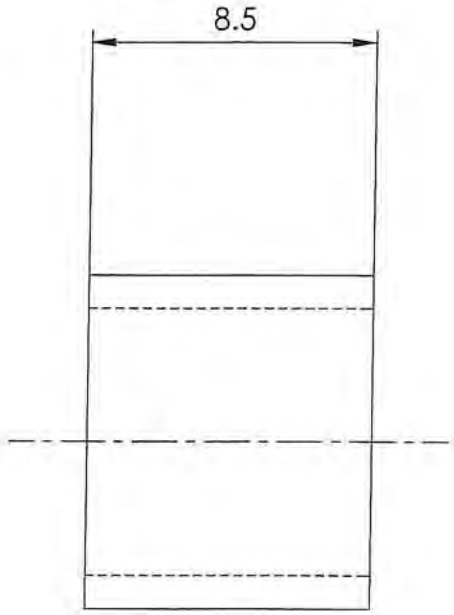
Title: **Bøjle til røgdæksel**

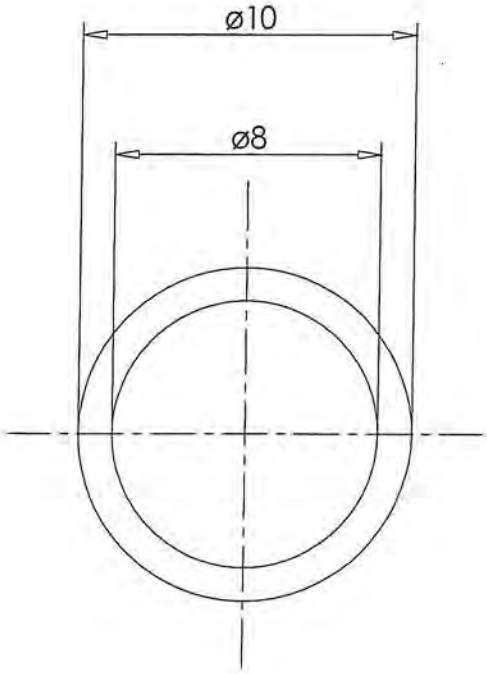
Morsø 5000

morsø
Bytecontrol as the first Danish Coun

Construction:	CHK	21.11.1994
Released:		
Format:	A4	
Scale:	1:1	
Itemno.:	545006	
Drawing no.:	5000-63 f	

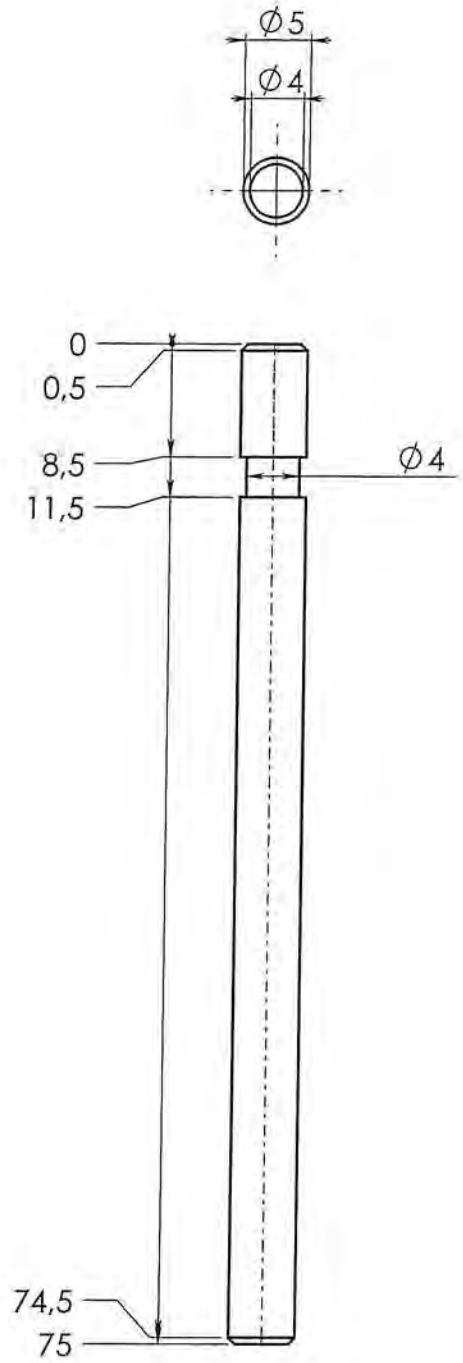
3-17 af 3-103





Ø10x1 Hydraulikrør galv.

Titel: Afstandsrør Til bøjle på røgdæksel	Sign.: RS	Dato: 970214	Revision	Sign.	Dato
	Tegn.form.: A4	Målforhold 5:1			
Tegningsnummer: 5000-64-4	Varenummer: 545007				
morsø Jernstøberi A/S	Filnavn: 5000-64				

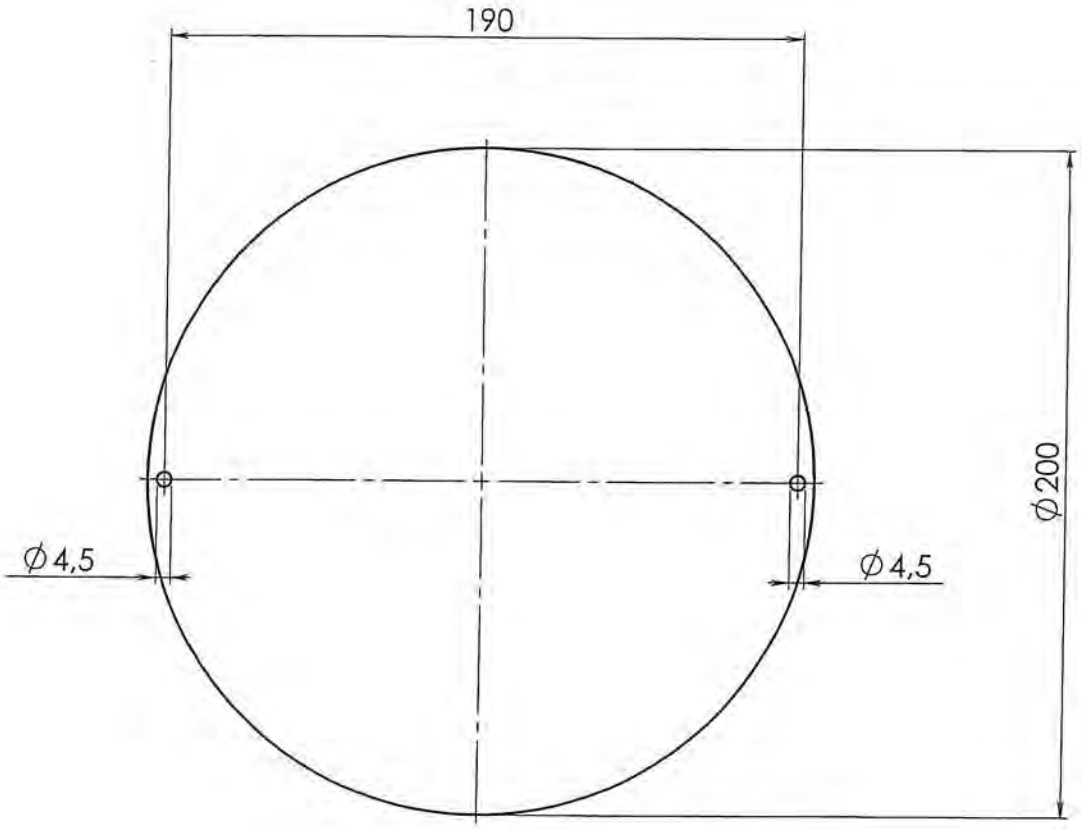


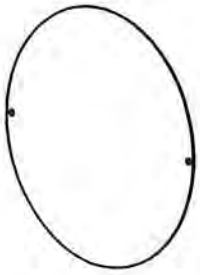
Rev.	Revisions	Sign.:	Date:

Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	Title: **Hængselsstift ø5x75**	Construction:	RSV	31.07.03
		Released:		
Material: Automatstål		Format:	A4	
Weight: 0,01 kg		Scale:	**2:1**	
Model no. -	**Morsø 5000**	Itemno.:	**545008**	
Drawingtype: Emnetegning	morsø	Drawing no.:	**5000-85 a**	
Location of file: u:\UGV\tegninger\standardbibliotek\Hængselstift.SLDPRT				

Date of print: 27-10-2005

3-99 + 3-103



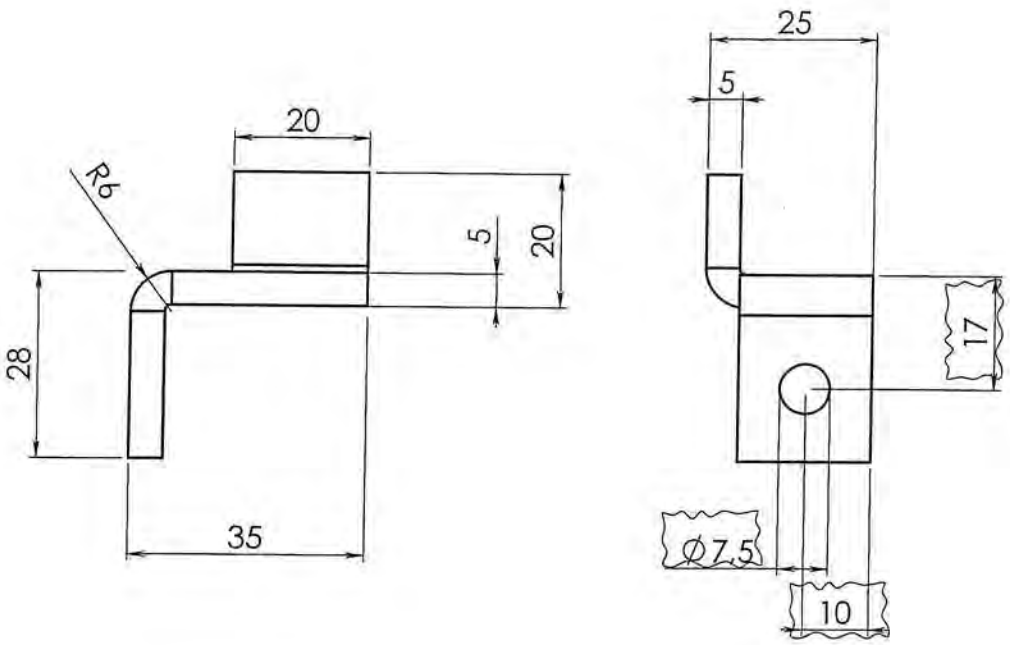


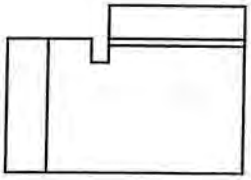
Rev.	Revisions	Sign.:	Date:

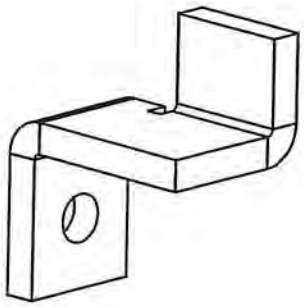
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	Title: Rundel ø 200mm	Construction:	KDU	02.02.05
		Released:	KDU	02.02.05
Material: SPD Plade		Format:	A4	
Weight: 0,25 kg		Scale:	1:1	
Model no. -	Morsø 5000	Itemno.:	545010	
Drawingtype: Emnetegning	morsø By appointment to the Royal Danish Court	Drawing no.:	5000-91 a	
Location of file: I:\ucdv\Tegninger\5000\TEGNING\5000-91 Rundel ø200 mm.SLDPRT				

Date of print: 27-10-2005

3-100 af 3-103





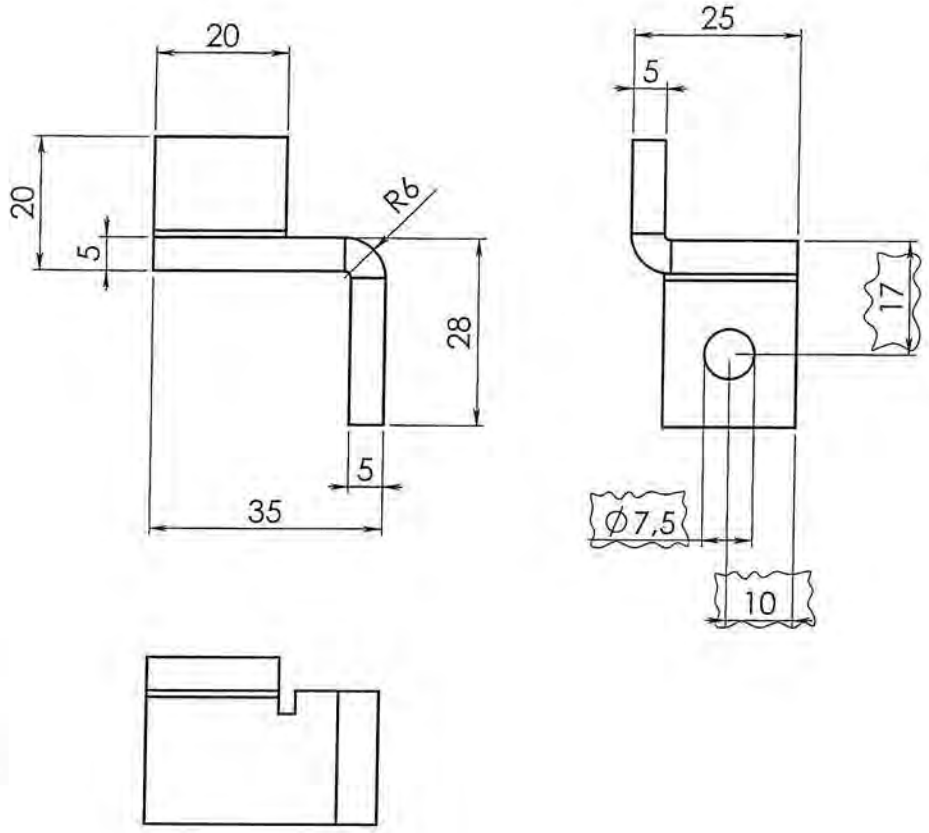


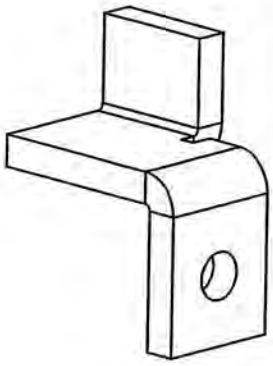
Rev.	Revisions	Sign.:	Date:
b	Materiale ændret til rustfri. Hul tilføjet.	KDU	27.01.05

Title: **Stopbeslag - venstre for varmeskjold Morsø 7110**	Construction:	KDU	14.01.04
	Released:	KDU	02.04.04
	Format:	A4	
	Scale:	1:1	
	Itemno.:	71711200	
morsø	Drawing no.:	7100-39 b	

Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	
Material:	Rustfri stål
Weight:	0,06 kg
Model no.	-
Drawingtype:	Emnetegning
Location of file:	U:\UDVV\tegninger\7100\7100-39 Stopbeslag varmeskjold - venstre.SLDPRT

Date of print: 27-10-2005



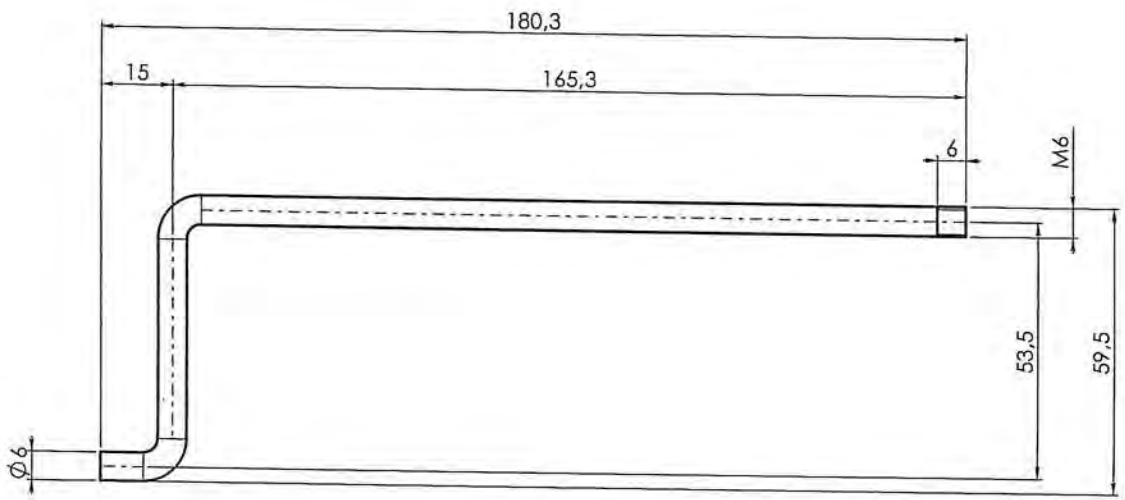


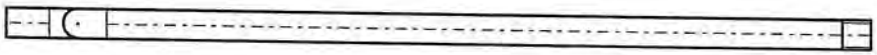
Rev.	Revisions	Sign.:	Date:
b	Materiale ændret til rustfri. Hul tilføjet.	KDU	27.01.05

Title:		Construction:	KDU	14.01.04
Stopbeslag - højre for varmeskjold Morsø 7110		Released:	KDU	02.04.04
		Format:	A4	
		Scale:	1:1	
		Itemno.:	71711300	
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m		Drawing no.:	7100-40 b	
Material:	Rustfri stål			
Weight:	0,06 kg			
Model no.	-			
Drawingtype:	Emnetegning			
Location of file:	U:\UDV\tegninger\7100\7100-40 Stopbeslag varmeskjold - højre.SLDPRT			

morsø
By appointment to the Royal Danish Court

Date of print: 27-10-2005





Rev.	Revisions	Sign.:	Date:

Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	
Material:	Automatstål
Weight:	0,05 kg
Model no.	
Drawingtype:	Emnetegning
Location of file:	

Title: **Rystestang**

Ø - 6

morsø

Construction:	RSV	23.09.02
Released:	RSV	11.06.03
Format:	A3	
Scale:	1:1	
Itemno.:	53001500	
Drawing no.:	Side 1 of 1	
	Steel-15 a	

3-103 af 3-103

Model: 8140
Morsø Jernstøberi A/S
Furvej 6 DK-7900
Nykobing Mors
DENMARK

Section 4

Manufacturer Owner's Manual

morsø

By appointment to the Royal Danish Court

Installation and Operating Instructions

8100 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-equirements 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: HEARTHLINK INTERNATIONAL
9 Maple St. - Randolph, Vermont - 05060 - USA

4-12 to 8-14

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 8100 series meets the U.S. Environmental Protection Agency's emission limits for wood heaters sold on or after July 1, 1990

The Morsø 8100 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.

CONTENTS:

4-8 of 4-12

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.

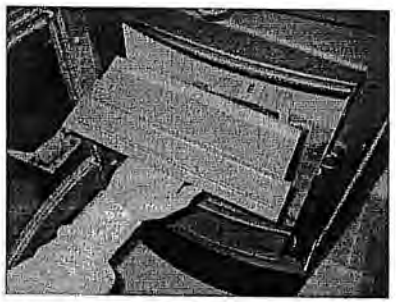
Do not connect to any air distribution duct or system.

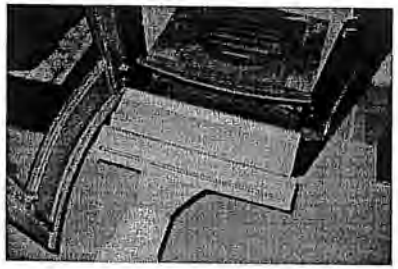
Important: If the installation instructions are not followed carefully, it may cause dangerous situations like chimney - and house fires. Follow the instructions carefully and do not deviate from them as it may cause injuries to people or property.

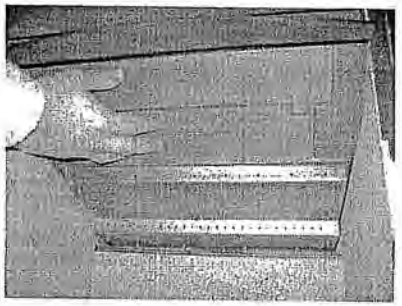
1.1 Checking loose parts in the stove

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 baffle is placed correctly, as shown on the images below.







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).

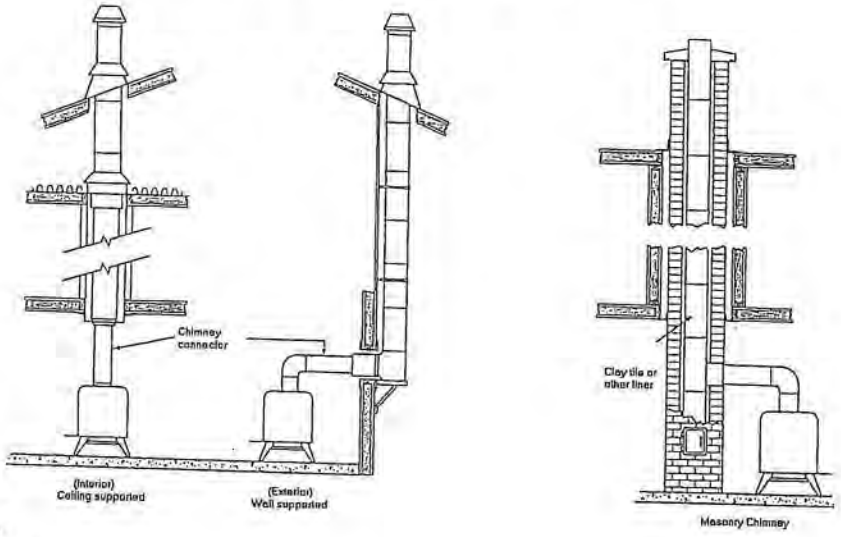
Use a residential type masonry or listed type HT factory-built chimney.

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 furnes under high heat. The connector must be 6 inches (150mm) in diameter.

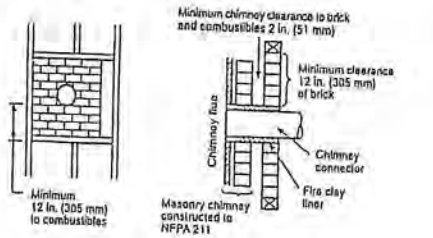
If possible, do not pass the chimney connector through a combustible wall or ceiling. If passage through a combustible wall is unavoidable, refer to the sections on Wall Pass- Throughs. Do not pass the connector through an attic, a closet or similar concealed space when installing the chimney connectors.

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 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.

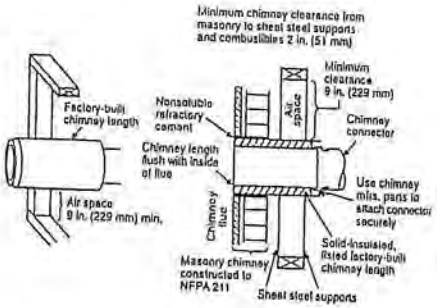
Be sure the installed stove and chimney connector are correct distances from near by combustible materials. See the clearance paragraph page 8.

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

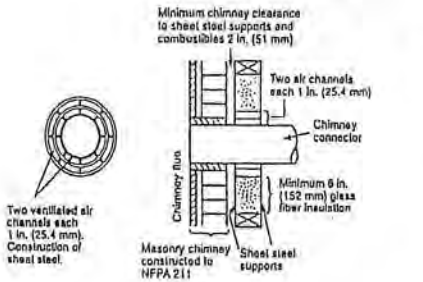
Chimney Connector Systems and Clearances from Combustible Walls for Residential Heating Appliances



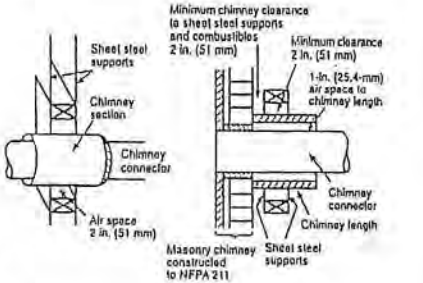
A Minimum 3.5-in thick brick masonry all framed into combustible wall with a minimum of 12-in brick separation from clay liner to combustibles. The fireclay liner shall run from outer surface of brick wall to, but not beyond, the inner surface of chimney flue liner and shall be firmly cemented in place.



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

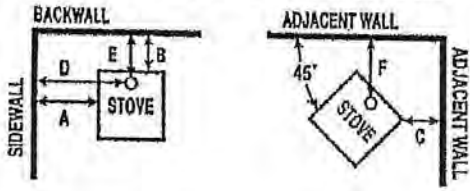
When the stove is positioned near *combustible* materials, observe all current local and national building regulations with regards to clearances. Whatever regulations apply to your area, do not in any case install the stove within 8 inches of combustible materials around the sides or 16 inches above 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.

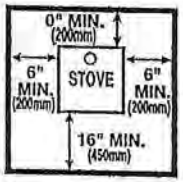
CLEARANCE REQUIREMENTS:	STANDARD RESIDENTIAL INSTALLATION (SINGLEWALL & DOUBLEWALL CONNECTOR):	
	USA	Canada
A. SIDEWALL TO UNIT B. BACKWALL TO UNIT C. CORNERWALL TO UNIT D. SIDEWALL TO CONNECTOR E. BACKWALL TO CONNECTOR F. CORNERWALL TO CONNECTOR G. UNIT TO CEILING H. FLOOR TO CEILING		

MINIMUM CLEARANCES TO COMBUSTIBLES:



CLEARANCE REQUIREMENTS:	ALCOVE INSTALLATION WITH (DOUBLE WALL CONNECTOR):
A. SIDEWALL TO UNIT B. BACKWALL TO UNIT C. CORNERWALL TO UNIT D. SIDEWALL TO CONNECTOR E. BACKWALL TO CONNECTOR F. CORNERWALL TO CONNECTOR G. UNIT TO CEILING H. FLOOR TO CEILING	

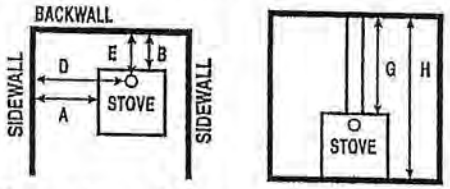
NON-COMBUSTIBLE FLOOR PROTECTOR



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

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

ALCOVE INSTALLATION



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

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

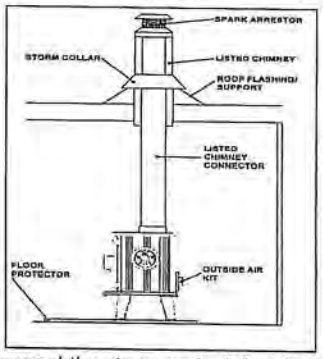
The Morsø 7110 can be installed in a mobile home if equipped with an outside combustion air kit, a terminal cap with a spark arrestor, and if it meets the following installation requirements:

- 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 a sleeping room.

4-2 of 4-13

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.)



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 15 inches (38 cm) and approx. 3 to 3.5 inches (7-8 cm) in section. If you can weigh your wood, aim for around 2 Lbs. The maximum moisture content of the wood should be around 20%.
Store the logs under cover in a location where fresh air can move through the stack. 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 it can cause performance problems, such as backpuffing and sluggishness, under certain conditions. Well seasoned wood will be remarkably light to hold and will probably have radial cracking at 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 is fitted wih Primary and Secondary 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 is fixed open and is not adjustable.
For extra safety, your stove has been fitted 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. Light the fire. An ember bed will quickly be formed by lighting with firelighters, morsø kindling bags or 7-10 pieces of twisted paper under the dry kindling wood (see below).
3. After lighting, partially close the door, leaving it open an inch or two to allow in plenty of combustion air.
4. When the chimney is warm after about 5-10 minutes, the door should be closed. A suitable layer of ember will be formed after a about 15-20 minutes.

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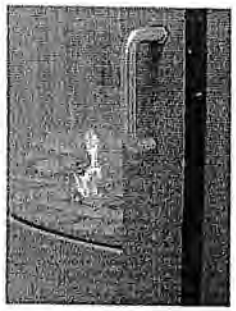
5. When ready to reload, use a poker to spread the ember across the firebox floor, bringing plenty towards the front of the stove.
6. Lay three pieces of wood onto the embers. Leave half an inch (1 cm) or more between each piece. When using 10 inch (25 cm) logs, place the ends of your logs towards the opening, but not too close to the front.
7. Close the door. Leave the primary air supply fully open.
8. After a few minutes, adjust the primary air supply to suit your heating requirements.
9. For refueling, add a layer of wood while there are still plenty of live embers, Repeat steps 5-8.



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 are left partly open, gas and flame may be drawn out of the fireplace stove opening, creating risks from both fire and smoke. We recommend you to 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.

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.

3.0 MAINTENANCE

When perfoming maintenance on your stove, always protect yourself, using safety goggles or 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

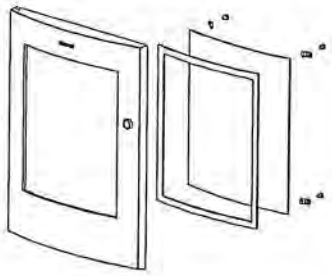
- **Fuel too wet**
- **Logs too large or not split**
- **Combustion temperatures too low**

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 small M4 unbraco screws, one in each hinge. Unscrew the two screws, 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 enought 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.

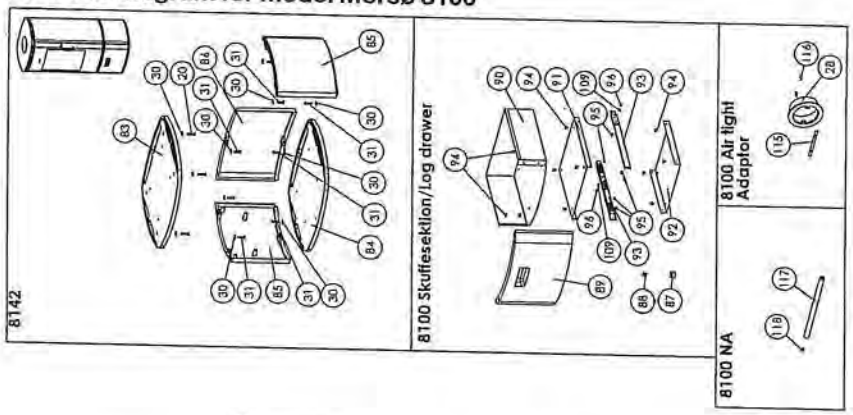
3.4 Leaving the stove for extended periods

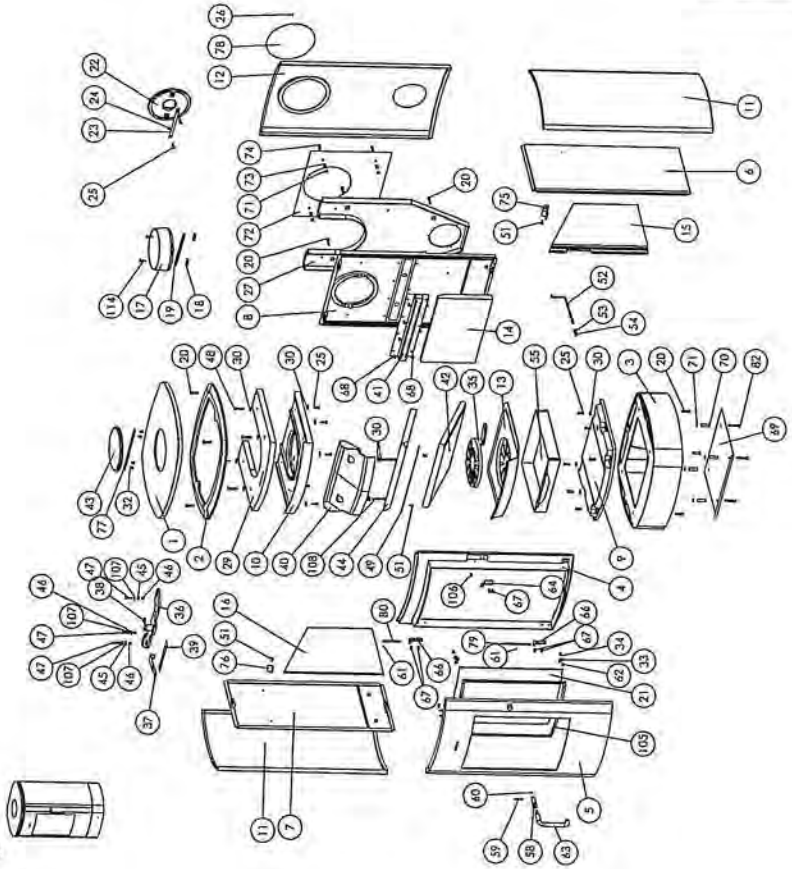
Important:
If the stove is to be left unused for any period of time, clean it out thoroughly and leave the air control slightly open to allow airflow. Make sure that the flue does not allow rainwater to come anywhere near the stove; install a chimney cap, but do not block off the flue completely.
These 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.

Thank you for buying a morsø stove.
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 8100





8140

3.6 Parts list for model Morsø 8100

Pos.No.	Parts	8140	8142
1	Top plate, outside	448110xx	448110xx
2	Top frame	448107xx	448107xx
3	Socle, high	348111xx	-
4	Front frame	448131xx	448131xx
5	Door	448103xx	448103xx
6	Side plate, right	44810400	44810400
7	Side plate, left	44812300	44812300
8	Rear plate, inside	44810500	44810500
9	Base plate, inside	44812200	44810100
10	Top plate, inside	44810600	44810600
11	Side plate, outside	448108xx	448108xx
12	Rear plate, outside	448109xx	448109xx
13	Intermediate frame	34811300	34811300
14	Brick, back	79810200	79810200
15	Brick, side, right	79810300	79810300
16	Brick, side, left	79810400	79810400
17	Flue collar	443441xx	443441xx
19	Stop bar	544541	544541
20	Screw	-	-
21	Ceramic glass	79810100	79810100
22	Cover	442610xx	442610xx
23	Flat bar	545006	545006
24	Distance tube	545007	545007
25	Screw	-	-
27	Air canal, rear	44811600	44811600
28	Air adaptor	44142600	44142600
29	Air canal, top	448117xx	448117xx
30	Washer	-	-
31	Screw	-	-
32	Screw	-	-
33	Glass fitting	790743	790743
34	Screw	-	-
35	Riddling grate	44182800	44182800
36	Sek. draught control	71814400	71814400
37	Handle f. sek. draught control	71810761	71810761
38	Screw	-	-
39	Closing plate	71810600	71810600
40	Air canal, front	44811500	44811500
41	Tertiary box	71810861	71810861
42	Baffle plate, bottom	79810500	79810500
43	Cover	448120xx	448120xx
44	Baffle plate, top	79810600	79810600
45	Distance tube	71810300	71810300
46	Distance tube	71810200	71810200
47	Screw	-	-
48	Screw	-	-
49	Fitting plate	71811161	71811161
50	Screw	-	-

Pos.No.	Parts	8140	8142
51	Screw	-	-
52	Riddling bar	53001500	53001500
53	Bush	752621	752621
54	Knob f. riddling bar	752619	752619
55	Ash tray	71811300	71811300
58	Bush	71813061	71813061
59	Hinge pin	541808	541808
60	Screw	-	-
61	Screw	-	-
62	Washer	-	-
63	Handle	75262800	75262800
64	Fitting f. closing plate	71813300	71813300
66	Hinge pin	71810100	71810100
67	Screw	-	-
68	Screw	-	-
69	Radiant shielding, bottom	71810400	71810400
70	Distance tube	542641	541439
71	Washer	-	-
72	Radiant shielding, rear	71811400	71811400
73	Distance tube	541439	541439
74	Screw	-	-
75	Stop fitting, left	71711200	71711200
76	Stop fitting, right	71711300	71711300
77	Fitting f. cover	71813200	71813200
78	Round plate	545010	545010
79	Hinge pin	54501800	54501800
80	Hinge pin	545008	545008
82	Screw	-	-
83	Bottom plate, outside socle	-	448112xx
84	Bottom plate, outside socle	-	448127xx
85	Leg	-	448118xx
86	Cover plate, rear, for leg	-	348121xx
87	Rubber stop block	-	79082007
88	Screw	-	-
89	Drawer, front	-	448119xx
90	Drawer, box	-	718127xx
91	Cover plate f. drawer section	-	718126xx
92	Mounting plate, drawer section	-	718128xx
93	Ball barrel	-	79082006
94	Screw	-	-
95	Screw	-	-
96	Screw	-	-
105	Tightening tape	79074200	79074200
106	Screw	-	-
107	Washer	-	-
108	Screw	-	-
109	Screw	-	-
114	Screw	-	-

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Model: 8140
Morsø Jernstøberi A/S
Furvej 6 DK-7900
Nykobing Mors
DENMARK

Section 5

Quality Assurance/Quality Control

Model: 8140
Morsø Jernstøberi A/S
Furvej 6 DK-7900
Nykobing Mors
DENMARK

QUALITY ASSURANCE/QUALITY CONTROL

O–TL 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 O–TL's Quality Assurance Manual.

O–TL'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).
- 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 O–TL's accreditation. Accreditation certificates are available upon request.

Model: 8140
Morsø Jernstøberi A/S
Furvej 6 DK-7900
Nykobing Mors
DENMARK

Sample Analysis

Analysis Worksheets
Tared Filter and Beaker Data
Solvent Blank Data

OMNI-Test Laboratories, Inc.
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: Morso
Model: 8100
Project #: 192-S-07-3 Tracking #: 786
Date: 10-6-05 Test Crew: BR Run #: 1
Sample Train #: A Train assembled by: BR
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI - 271
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 # M832 Tare wt. .5479 D/T in desiccator 10-6-05 1645 Preliminary wt.: .5679	10-7-05	1705	.5667	.5001	8	70	BR
	10-10-05	0835	.5653	.5001	11	69	BR
	10-11-05	0840	.5652	.5001	10	69	BR
Rear Filter Lab ID # M831 ID # .5476 Tare wt. D/T in desiccator: 10-6-05 1645 Preliminary wt.: .5496	10-7-05	1705	.5489	.5001	8	70	BR
	10-10-05	0835	.5488	.5001	11	69	BR
Acetone Rinse Lab ID # Beaker # 2108 Tare wt. 109.9144 Volume 95 ml Cleaned by: BR Solvent #: SA 075 D/T in desiccator: 10-10-05 0835 Preliminary wt.: 109.9211	10-11-05	0840	109.9198	.5001	10	68	BR
	10-12-05	0750	109.9198	.5001	8	69	BR

Technician signature: BR Date: 10-12-05

OMNI-Test Laboratories, Inc.
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: Morso
Model: 8100
Project #: 192-S-07-3 Tracking #: 786
Date: 10-6-05 Test Crew: B Davis Run #: 2
Sample Train #: A Train assembled by: BD
Balance ID #: OMNI - - 00023 Thermo/Hygro meter ID #: OMNI - 291
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 # M534 Tare wt. .5507 D/T in desiccator 10-7-05 0755 Preliminary wt.: .5810	10-8-05	0940	.5807	.5001	11	69	BR
	10-10-05	0835	.5802	.5001	11	69	BR
Rear Filter Lab ID # ID # M833 Tare wt. .5526 D/T in desiccator: 10-7-05 0755 Preliminary wt.: .5532	10-8-05	0940	.5530	.5001	11	69	BR
	10-10-05	0835	.5520	.5001	11	69	BR
	10-11-05	0840	.5516	.5001	10	69	BR
Acetone Rinse Lab ID # Beaker # 2206 Tare wt. 102.8320 Volume 85 ml Cleaned by: BR Solvent #: SA075 D/T in desiccator: 10-10-05 0835 Preliminary wt.: 102.8391	10-11-05	0840	102.8383	.5001	10	69	BR
	10-12-05	0755	102.8382	.5001	8	69	BR

Technician signature: B Davis Date: 10-12-05

OMNI-Test Laboratories, Inc.
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: Morso
Model: 8100
Project #: 192-S-07-3 Tracking #: 786
Date: 10-7-05 Test Crew: BR Run #: 3
Sample Train #: A Train assembled by: BR
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI - 2
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 # M886 Tare wt. .5528 D/T in desiccator 10-7-05 12:50 Preliminary wt.: .5639	10-8-05	18:40	.5633	.5001	9	68	BR
	10-11-05	0840	.5631	.5001	10	69	BR
Rear Filter Lab ID # ID # M835 Tare wt. .5489 D/T in desiccator: 10-7-05 12:50 Preliminary wt.: .5494	10-8-05	1840	.5487	.5001	9	68	BR
	10-11-05	0840	.5487	.5001	10	69	BR
Acetone Rinse Lab ID # Beaker # 2241 Tare wt. 116.4653 Volume 75 ml Cleaned by: BR Solvent #: SA075 D/T in desiccator: 10-10-05 0835 Preliminary wt.: 116.4734	10-11-05	0840	116.4722	.5001	10	69	BR
	10-12-05	0755	116.4721	.5001	8	69	BR

Technician signature: BR Date: 10-12-05

OMNI-Test Laboratories, Inc.
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: Morso
Model: 8100
Project #: 192-S-07-3 Tracking #: 786
Date: 10-7-05 Test Crew: BGAMS Run #: 4
Sample Train #: A Train assembled by: BA
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI - 291
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 # M838 Tare wt. .5455 D/T in desiccator 10-7-05 18:15 Preliminary wt.: .5526	10-8-05	18:40	.5524	.5001	9	68	BA
	10-11-05	0840	.5523	.5001	10	69	BA
Rear Filter Lab ID # ID # M837 Tare wt. .5438 D/T in desiccator: 10-7-05 18:15 Preliminary wt.: .5431	10-8-05	18:40	.5423	.5001	9	68	BA
	10-11-05	0840	.5423	.5001	10	69	BA
Acetone Rinse Lab ID # Beaker # 912 Tare wt. 104.3940 Volume 100 ml Cleaned by: BA Solvent #: 549075 D/T in desiccator: 10-10-05 0835 Preliminary wt.: 104.4015	10-11-05	0840	104.4001	.5001	10	68	BA
	10-12-05	0755	104.4000	.5001	8	69	BA

Technician signature: BA Date: 10-12-05

Date Placed in Desiccator	29-Sep-05	Balance ID Number	OMNI-00023	
Time Placed in Desiccator	8:25 AM	Audit Weight ID Number	OMNI-00131	
Technician	Davis	Thermometer/Hygrometer ID Number		

250 ml Beaker Tares

OMNI-Test Laboratories, Inc

250 ml Beakers ID Number											
	Date:	9/30/2005	10/3/2005								
	Time:	9:15 AM	8:00 AM								
	RH %:	12	10	0	0						
	T (F):	69	68	0	0						
	Tech.:	Davis	Davis								
	Audit:	0.5001	0.5001	0	0						
2241		116.4653	116.4653	X	0	0	Morso	8100	192-S-07-3	3	A
2206		102.8324	102.832	X	0	0	Morso	8100	192-S-07-3	2	A
912		104.3944	104.394	X	0	0	Morso	8100	192-S-07-3	4	A
2108		109.9144	109.9144	X	0	0	Morso	8100	192-S-07-3	1	A

Date Placed in Desiccator	18-Aug-05	Balance ID Number	OMNI-00023
Time Placed in Desiccator	8:10 AM	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:	8/25/2005	8/26/2005									
	Time:	7:50 AM	9:50 AM									
	RH %:	4	6		0		0					
	T (F):	74	80		0		0					
	Tech.:	Morgan	Davis									
	Audit:	0.5001	0.5001		0		0	Manufacturer	Appliance	Project No.	Run	Train
M831		0.5478	0.5476	X	0		0	Morso	8100	192-S-07-3	1	A
M832		0.5478	0.5479	X	0		0	Morso	8100	192-S-07-3	1	A
M833		0.5526	0.5526	X	0		0	Morso	8100	192-S-07-3	2	A
M834		0.5507	0.5507	X	0		0	Morso	8100	192-S-07-3	2	A
M835		0.5488	0.5489	X	0		0	Morso	8100	192-S-07-3	3	A
M836		0.5529	0.5528	X	0		0	Morso	8100	192-S-07-3	3	A
M837		0.5438	0.5438	X	0		0	Morso	8100	192-S-07-3	4	A
M838		0.5454	0.5455	X	0		0	Morso	8100	192-S-07-3	4	A

5-9 of 5-40

Model: 8140
Morsø Jernstøberi A/S
Furvej 6 DK-7900
Nykobing Mors
DENMARK

Calibrations

Method 28 and 5G

Method 28 and 5G:

ID #	Lab Name/Purpose	Log Name	Attachment Type
1	Calibrator Dry Gas Meter	Standard Test Meter – Rockwell Int'l	Calibration Log
21	Dry Gas Meter	Dry Gas Meter – Sierra-Misco	Post-Test Calibration Log
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" H2O – Dwyer	Calibration Log
131	500 mg Weight	Weight Standard, 500 mg – Ohaus	Calibration Log
132	10 lb Weight	Weight Standard, 10 lb.	Calibration Log
156	Incline Manometer	Incline Manometer 0-10" – Dwyer	Calibration Log
185	Platform Scale	Platform Scale – Weight-Tronix	Calibration Log
209	Barometer	Barometer – Princo	Manual Cover
262	Moisture Meter	Moisture Meter – Delmhorst	Manual
291	Relative Humidity Gauge	Digital Hygrometer/Thermometer-VWR	Calibration Log
300	Stopwatch	Stopwatch – Sportline	Calibration Log

Thermal Metering System Calibration
Y and dH@

Manufacturer:	Sierra-Misco
Model:	7200
Serial Number:	NA
OMNI Tracking No.:	21

Average Orifice Meter dH@	Average Gas Meter y Factor
1.640	0.999

Calibration Date:	10/12/05
Calibrated by:	B. Davis
Calibration Frequency:	8100 Post test
Next Calibration Due:	04/12/06
Instrument Range:	1.000 cfm
Standard Temp.:	68 oF
Standard Press.:	29.92 "Hg
Barometric Press.:	30.01 "Hg
Signature/Date:	10-12-05

Previous Calibration Comparision

Date	5/3/05	Acceptable	
dH@ Value	1.624	Deviation (5%)	Deviation
y Factor	0.988	0.0494	0.011
Acceptance	Acceptable		

Current Calibration

Acceptable y Deviation	0.020
Maximum y Deviation	0.006
Acceptable dH@ Deviation	0.200
Maximum dH@ Deviation	0.026
Acceptance	Acceptable

Reference Standard *			
Standard Calibrator	Model	Standard Test Meter	
	S/N	1	
	Calib. Date	20-Apr-05	
	Calib. Value	0.9823	y factor (ref)

Calibration Parameters	Run 1	Run 2	Run 3
Vacuum ("Hg)	0.00	0.00	0.00
dH ("H2O)	0.75	0.75	0.75
Initial Reference Meter	131.919	136.934	141.985
Final Reference Meter	136.934	141.927	147.019
Initial DGM	849.8	854.915	860.1
Final DGM	854.915	860.025	865.263
Temp. Ref. Meter (°F), Tr	65.0	63.0	62.0
Temperature DGM (°F), Td	82.0	87.0	87.0
Time (Minutes)	10.0	10.0	10.0
Net Volume Ref. Meter, Vr	5.015	4.993	5.034
Net Volume DGM, Vd	5.115	5.11	5.163
Gas Meter y Factor =	**0.992**	**1.002**	**1.002**
Gas Meter y Factor Deviation (from avg.)	0.006	0.003	0.003
Orifice dH@	**1.66**	**1.65**	**1.61**
Orifice dH@ Deviation (from avg.)	0.020	0.007	0.026

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

Standard Gas Test Meter Calibration vs. Bubble Flowmeter

Date: 4/20/05

Calibrated by: K. Morgan

Standard Test Meter S/N: OMNI 00001

Bubble Flow Meter S/N: OMNI 00134 (Volume: 1.000 liters = 0.035336 ft3, NIST traceable)

Barometric Pressure: 29.94 "Hg

Average Y Factor: 0.9823

Signature/Date: K. Morgan 4-20-05

Flow Rate #1

dH(pressure across meter, "H2O): 0.1

	Run #1	Run #2	Run #3
Standard Test Meter			
Initial Volume (ft3):	941.687	942.593	943.237
Final Volume (ft3):	942.56	943.237	944.003
Initial Temperature (oF):	78	78	79
Final Temperature (oF):	79	79	79
Elapsed Time (minutes):	4	3	3
(seconds):	0	0	30
Flow rate, Q (cfm):	0.2182	0.2147	0.2189
Bubble Flowmeter			
Time 1:	9.91	9.87	9.83
Time 2:	9.83	9.92	9.83
Time 3:	9.9	9.92	9.83
Time 4:	9.84	10	9.91
Time 5:	9.94	9.88	9.9
Initial Temperature (oF):	78	79	79
Final Temperature (oF):	78	79	79
Vacuum ("H20):	1	1	1
Flow rate, Q (cfm):	0.2145	0.2138	0.2150
Y factor:	**0.9835**	**0.9946**	**0.9823**

Deviation of Y factor is acceptable

Flow Rate #2

dH(pressure across meter, "H2O): 0.23

	Run #1	Run #2	Run #3
Standard Test Meter			
Initial Volume (ft3):	944.414	946.058	946.713
Final Volume (ft3):	946.058	946.713	947.52
Initial Temperature (oF):	79	81	81
Final Temperature (oF):	81	81	81
Elapsed Time (minutes):	5	2	2
(seconds):	0	0	30
Flow rate, Q (cfm):	0.3288	0.3275	0.3228
Bubble Flowmeter			
Time 1:	6.72	6.53	6.59
Time 2:	6.56	6.62	6.63
Time 3:	6.64	6.59	6.59
Time 4:	6.54	6.63	6.61
Time 5:	6.65	6.59	6.67
Initial Temperature (oF):	79	81	81
Final Temperature (oF):	81	81	81
Vacuum ("H20):	1	1	1
Flow rate, Q (cfm):	0.3202	0.3216	0.3204
Y factor:	**0.9735**	**0.9818**	**0.9922**

Deviation of Y factor is acceptable

Flow Rate #3

dH(pressure across meter, "H2O): 0.3

	Run #1	Run #2	Run #3
Standard Test Meter			
Initial Volume (ft3):	948.092	949.054	950.2
Final Volume (ft3):	949.054	950.2	951.143
Initial Temperature (oF):	81	81	82
Final Temperature (oF):	81	82	83
Elapsed Time (minutes):	2	3	2
(seconds):	30	0	30
Flow rate, Q (cfm):	0.3848	0.3820	0.3772
Bubble Flowmeter			
Time 1:	5.66	5.66	5.74
Time 2:	5.74	5.56	5.74
Time 3:	5.6	5.64	5.72
Time 4:	5.56	5.74	5.66
Time 5:	5.61	5.72	5.7
Initial Temperature (oF):	81	82	83
Final Temperature (oF):	81	82	83
Vacuum ("H20):	1	1	1
Flow rate, Q (cfm):	0.3763	0.3743	0.3712
Y factor:	**0.9777**	**0.9788**	**0.9829**

Deviation of Y factor is acceptable

Flow Rate #4

dH(pressure across meter, "H2O): 0.38

	Run #1	Run #2	Run #3
Standard Test Meter			
Initial Volume (ft3):	951.791	952.636	953.487
Final Volume (ft3):	952.636	953.487	954.335
Initial Temperature (oF):	82	82	82
Final Temperature (oF):	82	82	83
Elapsed Time (minutes):	2	2	2
(seconds):	0	0	0
Flow rate, Q (cfm):	0.4225	0.4255	0.4240
Bubble Flowmeter			
Time 1:	5	5.08	4.86
Time 2:	5.1	5.06	4.94
Time 3:	5.1	4.98	5
Time 4:	5.11	5	4.99
Time 5:	5	5.02	4.96
Initial Temperature (oF):	82	82	82
Final Temperature (oF):	82	82	83
Vacuum ("H20):	1	1	1
Flow rate, Q (cfm):	0.4188	0.4217	0.4283
Y factor:	**0.9911**	**0.9908**	**1.0099**

Deviation of Y factor is acceptable

Standard Gas Test Meter Calibration vs. Bubble Flowmeter

Date: 4/20/05
Calibrated by: K. Morgan
Standard Test Meter S/N: OMNI 00001
Bubble Flow Meter S/N: OMNI 00134 (Volume: 1.000 liters = 0.035336 ft3, NIST traceable)
Barometric Pressure: 29.94 "Hg

Average Y Factor: 0.9823

Signature/Date: _____

Flow Rate #5 dH(pressure across meter, "H2O): 0.58			
	Run #1	**Run #2**	**Run #3**
Standard Test Meter			
Initial Volume (ft3):	956.397	957.689	958.711
Final Volume (ft3):	957.689	958.711	959.725
Initial Temperature (oF):	83	83	84
Final Temperature (oF):	84	84	85
Elapsed Time (minutes):	2	2	2
(seconds):	30	0	0
Flow rate, Q (cfm):	0.5168	0.5110	0.5070
Bubble Flowmeter			
Time 1:	4.34	4.26	4.34
Time 2:	4.26	4.26	4.36
Time 3:	4.34	4.29	4.26
Time 4:	4.3	4.28	4.26
Time 5:	4.34	4.28	4.24
Initial Temperature (oF):	83	83	84
Final Temperature (oF):	84	84	85
Vacuum ("H20):	1	1	1
Flow rate, Q (cfm):	0.4912	0.4961	0.4940
Y factor:	**0.9503**	**0.9705**	**0.9741**
Deviation of Y factor is acceptable			

Acceptance criteria, Method 5 section 16.1.1.5
- The difference between the maximum and minimum values at each flow rate should be no greater than 0.030.
- The meter coefficients (Y) should be between 0.95 and 1.05.

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 ~~03~~
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
		Installed new vane from factory	
		Installed new vane from factory	
		Installed new vane from factory	
		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.

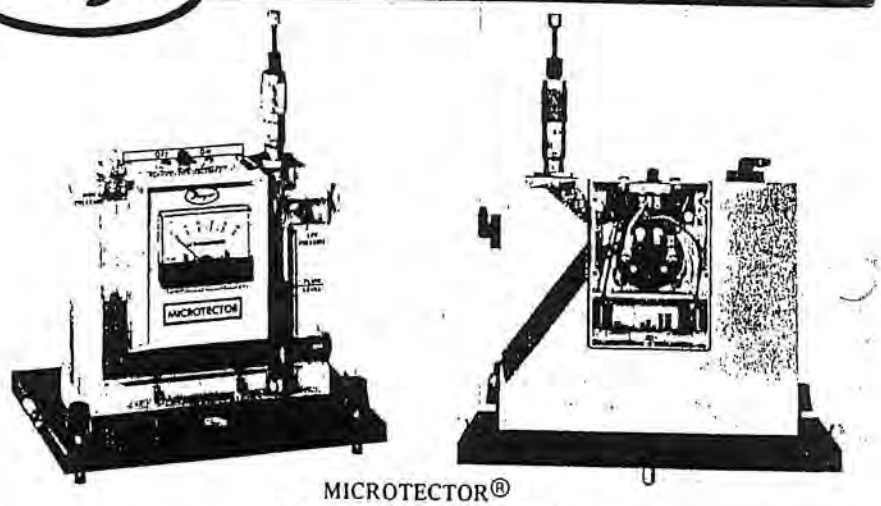
If meter becomes inoperative and cannot be made to operate properly by cleaning point tip or replacing battery, return the entire gage to Dwyer Instruments, Inc., for service.

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

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.

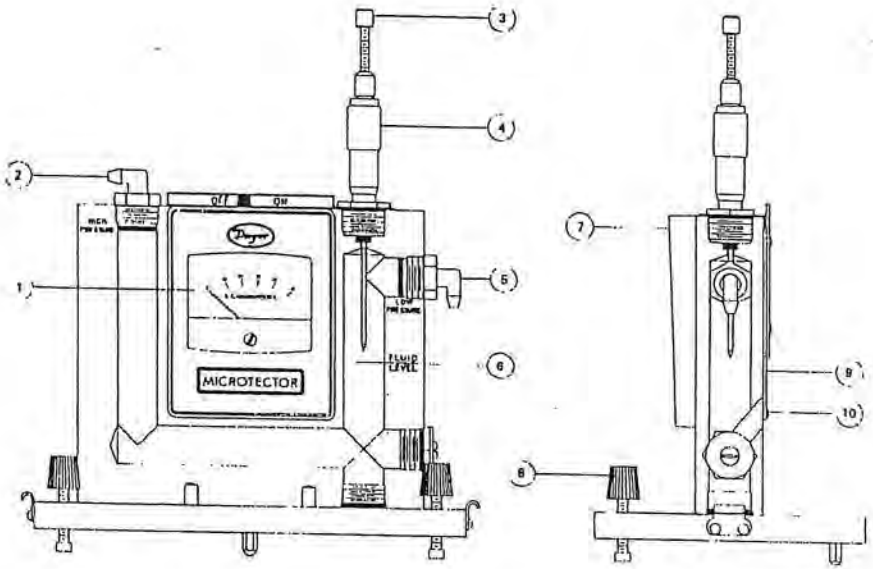
Rugged Sheet Steel Cover and Carrying Case Protects the Entire Unit When Not In Use.

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



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.

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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 "hook" 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 "hook." 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 circuit on and "hook" point in fluid), the following should be done:

1. Remove the hook 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 solvents, 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 "hook" tip or replacing battery, return the entire gage to Dwyer Instruments, Inc., for service.

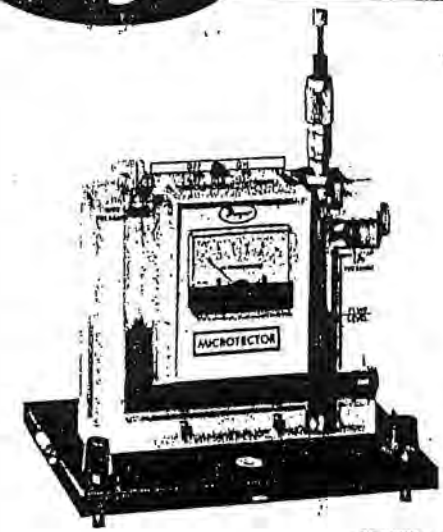
"Microtector" ®
A Product From
Dwyer Instruments, Inc.,
"The Low Pressure People"

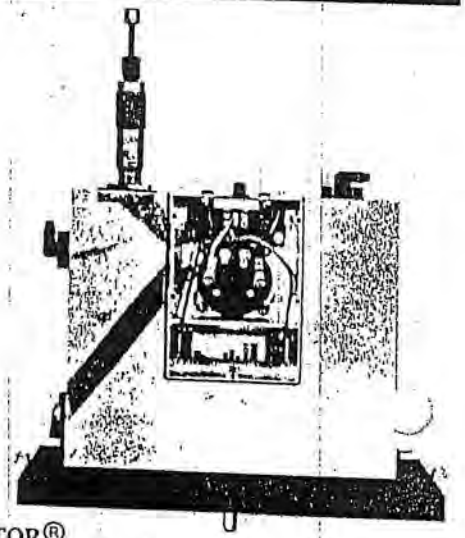
38-440190-00

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

...ICRO...TOR.

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 ±.00025 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.

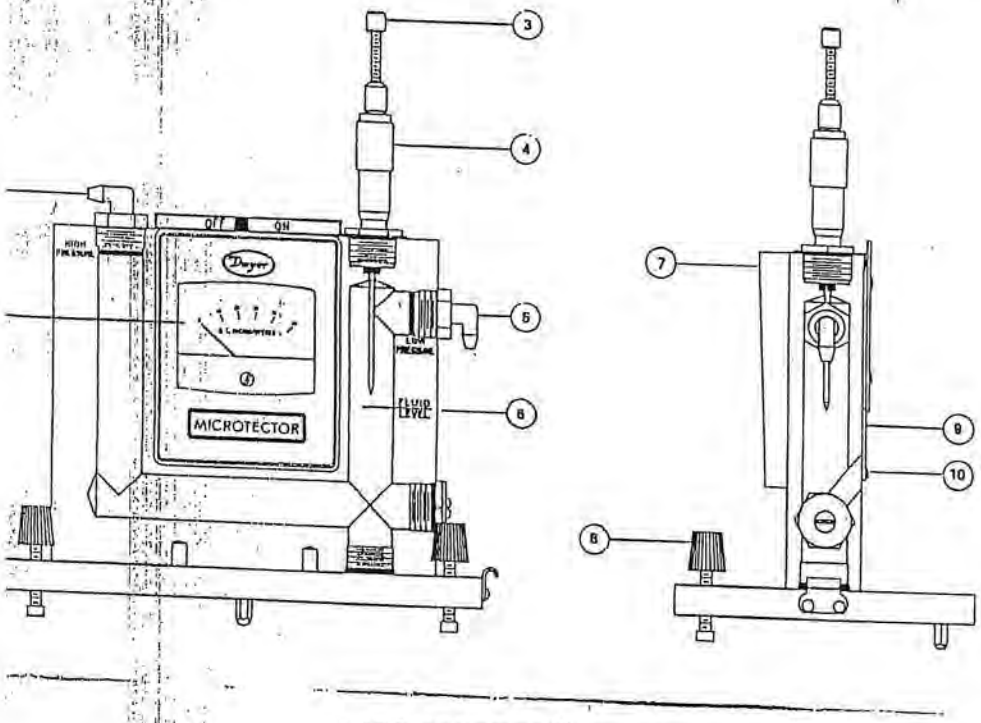
Top Quality Glass Epoxy Circuit Board and Solid State-Integrated Circuit Electronics.

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*



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 hook is then lowered until it 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 semi-conductor 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 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 [illegible] 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 [illegible] 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

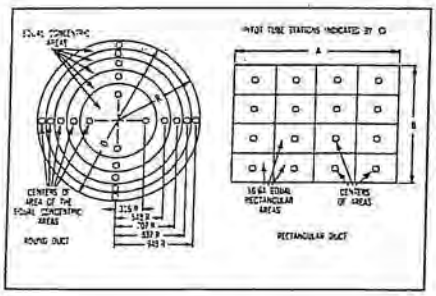
AIR VELOCITIES WITH THE DWYER PITOT TUBE

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:

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

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

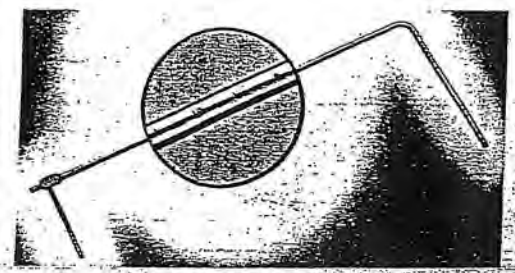
$$\text{Air Density} = 1.325 \times \frac{P_B}{T}$$

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. 8/84

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

CALIBRATION INSTRUCTIONS
Microtector and Standard Type Pitot Tube

Calibration Description:	Microtector and Standard Type Pitot Tube
Instrument Name:	Hook Gage Liquid Manometer with Micrometer Gage in Inches.
Manufacturer:	Dwyer Instruments, Inc. P. O. Box 373 Michigan City, Indiana 46360 (219)872-9141
Style/Model:	1430
Serial Number:	N/A (OMSE 33)
OMNI Tag #:	OMNI-00033
Sample Flow Range:	N/A
Resolution:	N/A
Sensitivity:	N/A
Accuracy:	± .00025 inches water column
Range:	0-2" w.c. Positive, Negative, or Differential Pressures
Frequency of Calibration:	Instrument is zeroed before each use. Recalibrated by service company after repairs.
Calibrator:	Emissions testing technicians
Reference Standard:	
Comments:	Battery replaced when necessary

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

Temperature Calibration
EPA Method 28 and 5G

Booth:	Temperature Monitor Type:	Identification Number:
Emissions	Type K digital readout	112

Reference Temperature Monitor Type:	Identification Number:
OMEGA Calibrator Model CL300	Serial Number 506

Calibration Performed By:	Date:	Ambient Temperature:	Barometric Pressure:
B. Davis	5-3-05	69	29.88

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	001	000	000	000	000	000
100	100	100	100	100	99	100
300	303	303	303	303	303	303
500	501	501	501	502	500	501
700	701	701	701	701	702	701

Technician signature: _____ Date: 5-11-05

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

DIFFERENTIAL PRESSURE GAUGE CALIBRATION DATA SHEET
Magnehelic Gauge

Instrument to be calibrated: Magnehelic

Range: 0-.25" ID Number: 126

Calibration Instrument: ~~Liquid~~ digital Manometer ID Number: 315

Date: 7-6-05 By: BDAVIS

~~Liquid~~ Digital Manometer (A) (inches of H_20)	Magnehelic Gauge (B) (inches of H_20)	Difference (A - B)	% Error of Full Span*
.237	.24	.003	1.2
.143	.15	.007	2.8
.059	.06	.001	0.4
.011	.015	.004	1.6

*Acceptable tolerance is 4%.

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

Technician signature: BD Date: 7-6-05

Certificate of Calibration

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

For: OMNI-TEST LABORATORIES 56

Department: NO PO#: PAM BLACKBURN

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

Issued 19Nov2003

Rev # 11

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

Supplement Data Sheet
Bold Italics indicates Out of Tolerance Value.

5-24 of 5-40

Certificate of Calibration

Certificate # **232180** Page # 1 of 1 Order Date: 28Sep2001

For: OMNI-TEST LABORATORIES

Department: NO PO#: OTL-01-137

56

JJ Calibrations, Inc.

Instrument Identification

Property #: 27502 Serial #: 27502

Make: UNKNOWN User:

Model: 10lb

Noun: 10lb WEIGHT

Accuracy: ASTM E617

Certification Information

As Found: Within Tolerance Cal Date: 03Oct2001

As Left: Within Tolerance *Due Date: 03Oct2002

Adjustments: None Repairs: None Seals: N/A Environment: 21°C 44% RH

Procedure: CP 16 Technician: 49

Remarks

*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	HP-30K	30k GRAM BALANCE	06Feb2002	210998

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; MIL-STD-45662A and ISO-9002.
A Test Accuracy Ratio (TAR) of at least 4:1, if achievable, is maintained unless otherwise stated.

Tom Moody
Manager

Jodi L Martine
Quality Assurance

Issued 04Oct2001
Rev # 11

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

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

DIFFERENTIAL PRESSURE GAUGE CALIBRATION DATA SHEET
Liquid Manometer Gauge

Instrument to be calibrated: Inclined Manometer 0.1

Range: 0- 10" H_2O ID Number: 156

Calibration Instrument: Liquid Manometer ID Number: 275

Date: 5-3-05 By: BOAUS

digital

~~Liquid~~ Manometer (A) REF. (inches of H_20)	Liquid Manometer (B) (inches of H_20)	Difference (A - B)	% Error of Full Span*
1.99	2.0	0.01	0.1
0.99	1.0	0.01	0.1
0.63	0.65	0.02	0.2
0.34	0.35	0.01	0.1

*Acceptable tolerance is 4%.

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

Technician signature: BOA Date: 5-11-05

H.W. BRUCE DAVIS

Weigh-Tronix, Inc.
7933 SW Nimbus Ave. #28
Beaverton, OR 97005
503-626-3008
1-800-678-3008

WEIGH-TRONIX

SERVICE WORK ORDER

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

JOB No. T111991
CUSTOMER No.
Order Date / /
Start Date / /
Complete Date 1/11/99

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

P.O. No. 99-007

EQUIPMENT

S/N	Location	Type	Cap.	Recommendations and Remarks
5617		WI-127	1K	10,000 DIV
21676		3030	1K	

COMMENTS

Rental 1 Month

Set up calibrated 1000 x 0.1 LB pea. caden tested. good.

PARTS

2.5

Qty.	Description	Price	Total

ZONE _____ VEHICLE _____
TECHNICIAN 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

WEIGH-TRONIX
Rental / Sales / Service

Print Name Bruce Davis

DAMAGE TO RENTAL/DEMO EQUIPMENT IS SOLELY THE RESPONSIBILITY OF THE USER WHILE IN THEIR POSSESSION!

DISTRIBUTION: WHITE – OFFICE YELLOW – FILE PINK – CUSTOMER

OMNI 00209

Instruction Booklet

for use with

PRINCO

Fortin type mercurial

Barometers

453
National
Weather
Service
Type

Manufactured by

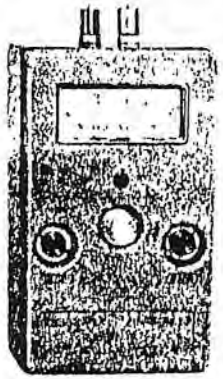
PRINCO INSTRUMENTS, INC.
1020 Industrial Blvd.
Southampton, Pa. 18966-4095
U.S.A.

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

469
NOVA™
Economy
Model

5-28 + 5-40

OWNER'S MANUAL



MOISTURE DETECTORS FOR WOOD

DELMHORST INSTRUMENT COMPANY

DELMHORST INSTRUMENT COMPANY
BOONTON, N.J. 07005

5074-578

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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.

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.

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.

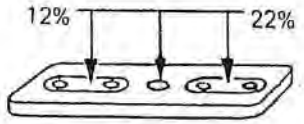
CALIBRATION MOISTURE STANDARDS

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).

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.

15E

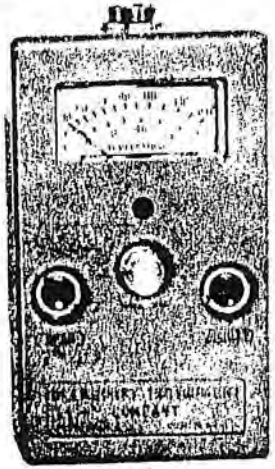
TYPE 15E – Eight-pin electrode for veneer. Pins penetration is 1/8". Electrode can be used for checking veneer m.c. at end of dryer, at time of gluing and for incoming inspection. Weight ½ lb.

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" Flashlight 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

OTHER INSTRUMENTS AVAILABLE

Electronic THERMOMETER
Model TM-2

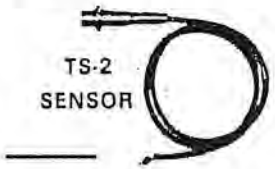


The TM-2 is a solid-state, portable battery operated instrument.

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

RANGES

TM-2 (30°-150°F / 0-65°C.)
TM-3 (−20°-110°F)
TM-4 (100°-250°F)
TM-5 (−20°-200°F)



TS-2 SENSOR

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

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 ovendry 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).

Certificate of Calibration

Certificate # **315146** Page # 1 of 1 Order Date: 27Jan2005

For: OMNI-TEST LABORATORIES 56

Department: NO PO#: OTL-05-007

JJ Calibrations, Inc.

#0723.01

Instrument Identification

Property #: OMNI-00291 Serial #: 9190156

Make: OMEGA User:

Model: RH82

Noun: THERMO HYGROMETER

Accuracy: Refer to Specifications

Certification Information

As Found: Within Tolerance Calibration Date: 31Jan2005

As Left: Within Tolerance *Client Specified Due Date: 31Jan2006

Adjustments: None Repairs: None Seals: Intact Environment: 23°C 35% RH

Procedure: CP 11 Technician: 40

Remarks

Refer data sheet.

*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
464A	GENERAL EASTERN	M4-RH/D2	HUMIDITY STANDARD	10Dec2005	312016
497A	HART SCIENTIFIC	1502A	TWEENER THERMOMETER	09Aug2005	302848
498A	BURNS ENGR.	200G05B085	INDUSTRIAL PRT	29Dec2005	312022

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

Issued 01Feb2005

Rev # 11

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

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JJ Calibrations, Inc.

Manufacturer: Omega
Model: RH82
Nomenclature: Thermo Hygrometer
Serial: 9190156

Certificate #: 315146
Date: 31Jan2005
Technician: 40
Calibration Interval: 12 Months

Parameter		Reference Standard	UUT Before	UUT After	UUT ± Limit	Uncertainty ±
Humidity Accuracy		30.1%	31.2%	31.2%	3.0%	N/A
		70.1%	69.5%	69.5%	3.0%	N/A
Temperature Accuracy		74.9°F	75.6°F	75.6°F	1.8°F	N/A

Supplement Data Sheet

Bold Italics indicates Out of Tolerance Value.

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

NIST Stopwatch Calibration, Time Proficiency Testing Procedure and Data Sheet

Date: 10 / 3 / 05 User/Technician: B Davis ☒ Pass ☐ Fail

NIST traceable stop watch OMNI Tracking Number: 292 Last Cal: JAN 31 2005

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: 15:00 #2 Measured time: 15:03 #3 Measured time: 14:97

Target time: 30.00 seconds #1 Measured time: 30:03 #2 Measured time: 30:12 #3 Measured time: 30 00

Target time: 10.00 minutes #1 Measured time: 10:00.03 #2 Measured time: 10:00.16 #3 Measured time: 10:00 25

Target time: 30.00 minutes #1 Measured time: 30:00 #2 Measured time: 29:59.97 #3 Measured time: 29:59.94

Technician Signature: B Davis Date: 10-3-05

Section 6

Example Calculations

Note: OMNI-Test Laboratories, Inc. uses the Excel 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:

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

$m_n = 16.2$ 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: $85.49 \frac{ft}{\text{sec}} \left[\frac{(lb/lb\text{-}mole) \times (inches\ Hg)}{(^\circ R) \times (inches\ H_2O)}\right]^{\frac{1}{2}}$

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:

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

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

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

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 "ith" 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 "ith" 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):

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

$$PR = 103.8\%$$