Certification Test Report

Morsø Jernstøberi A/S

Freestanding Wood Stove
Model: 2B

Report Number 192-S-09-3

OMNI-Test Laboratories, Inc.
Product Testing & Certification

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Certification Test Report

Morsø Jernstøberi A/S

Freestanding Wood Stove

Model: 2B

Prepared for:	Morsø Jernstøberi A/S Furvej 6 7900 Nykøbing Mors Denmark
Prepared by:	*OMNI*-Test Laboratories Inc. 5465 SW Western Avenue, Suite G Beaverton, OR 97005 (503) 643-3788
Test Period:	July 18 through July 19, 2006
Report Date:	July 2006
Project Number:	192-S-09-3

AUTHORIZED SIGNATORIES

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

Richard Sparwasser, Vice President
OMNI-Test Laboratories Inc.

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

Ken Morgan, Technician
OMNI-Test Laboratories Inc.

TABLE OF CONTENTS

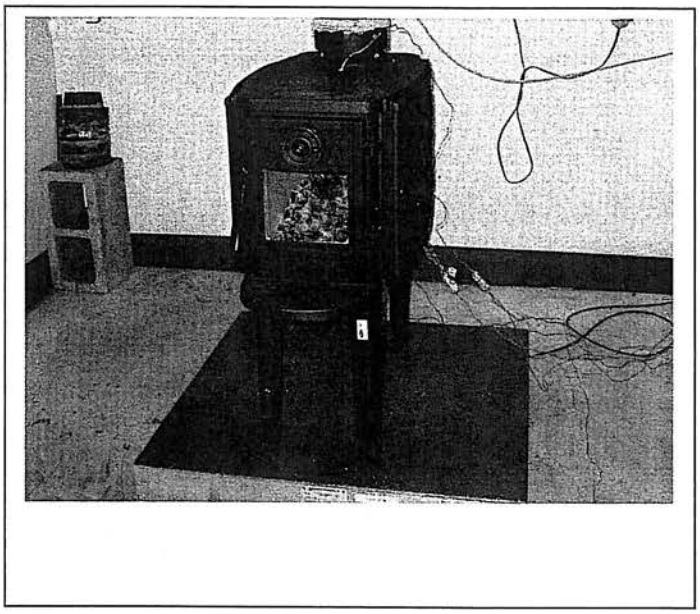
Section 1

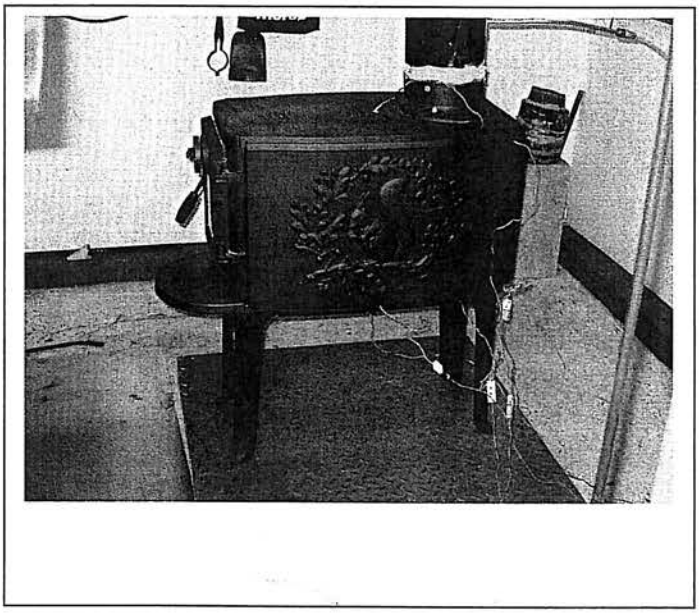
Fuel Photographs/Appliance Description/Drawings

Morsø Jernstøberi A/S

2B

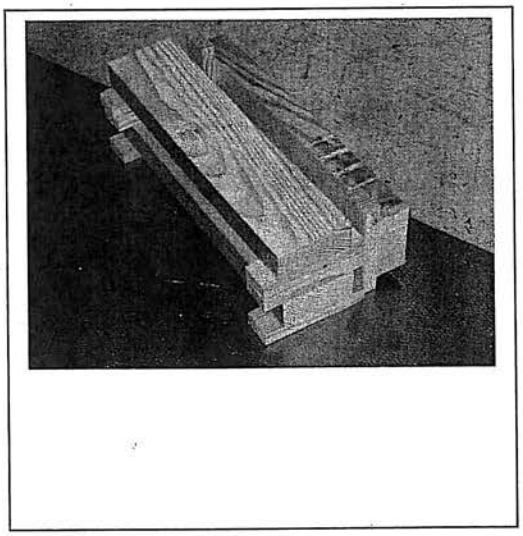
Test Dates: July 18 through July 19, 2006



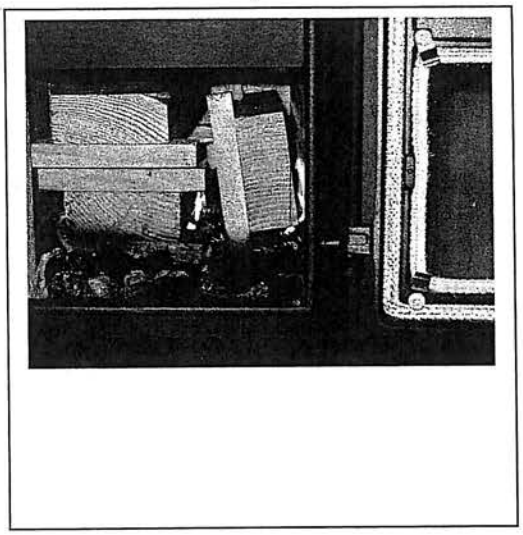


Morsø Jernstøberi A/S
2B

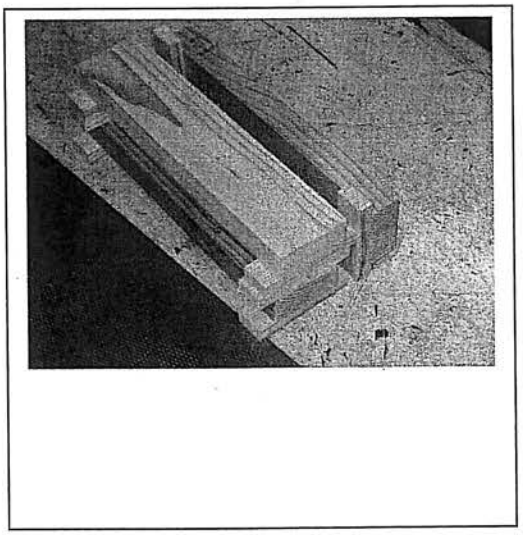
Run 3 – Fuel



Run 3 - Newly Loaded Stove



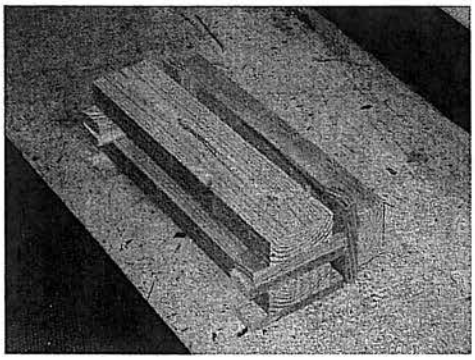
Run 4 – Fuel



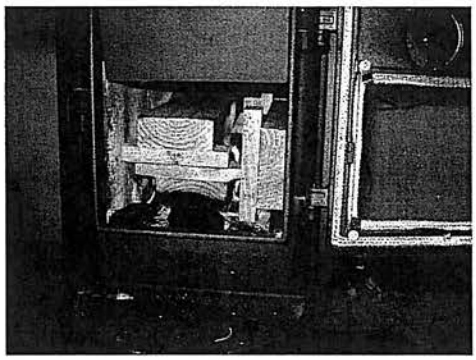
Run 4 - Newly Loaded Stove

Morsø Jernstøberi A/S
2B

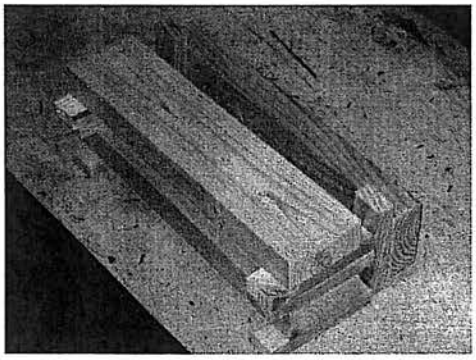
Run 1 – Fuel



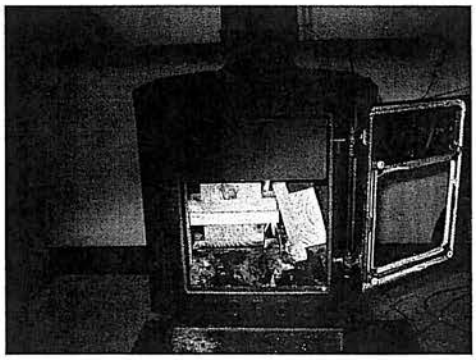
Run 1 - Newly Loaded Stove



Run 2 – Fuel



Run 2 - Newly Loaded Stove



APPLIANCE INFORMATION

Appliance Manufacturer: Morsø Jernstøberi A/S

Wood Stove Model: 2B

Type: Freestanding, radiant-type room heater

WOOD HEATER DESCRIPTION

Materials of Construction: The unit is constructed primarily of cast iron and the firebox is lined with vermiculite. The feed door has a 6" by 5.75" glass panel.

Air Introduction System: Air enters the firebox through a spin-draft located at the front of the appliance at the top of the fuel-loading door. Secondary air enters the appliance through the upper back and supplies a three-step, tiered hollow baffle.

Combustion Control Mechanisms: The combustion air inlet is controlled by a spin-draft located at the top of the fuel-loading door in the center of the appliance.

Combustor: N/A.

Internal Baffles: A hollow, tiered baffle with a cast iron extension 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. A ceramic wool blanket is employed on the top of the baffle.

Other Features: None.

Flue Outlet: The 5" diameter flue outlet is located at the top of the unit.

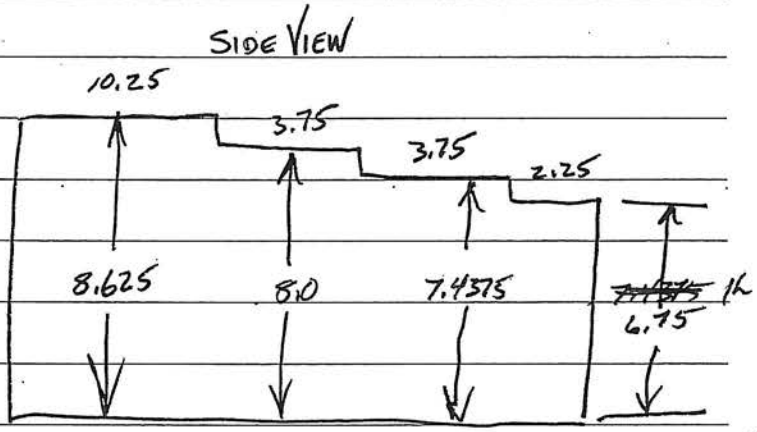
WOOD HEATER OPERATING INSTRUCTIONS

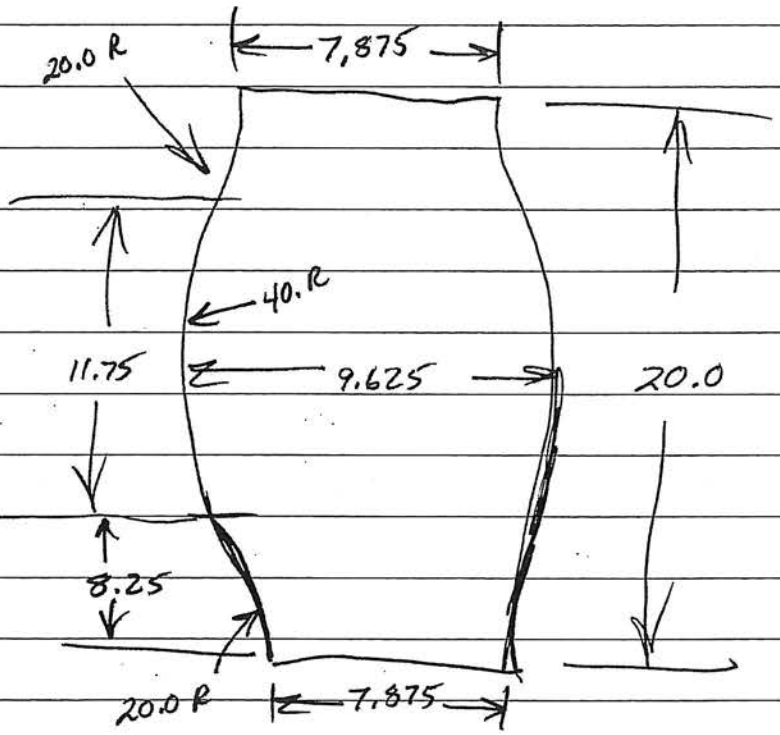
Specific written instructions: See Section 4 of this report. All markings and instruction materials were reviewed for content prior to printing.

Engineering Drawings/Blueprints (K List)

NOTES

Morso 2B Firebox Volume Calculation





Hearth Plan View

CAD Query: 1392.6392 in
= .806 ft³

5.642 lb IDEAL
5.1 - 6.2

Project Number: 192-S-09-3 Technician Initialed: JL

Date: 7-17-06 OMNI ID: 879

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.

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Fax: +1 (704) 544-1239

www.skamol.com

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

March 2004

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

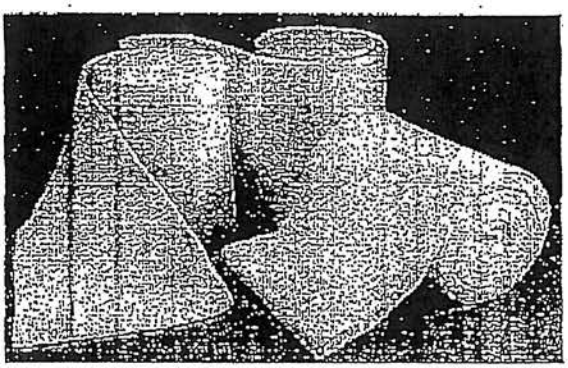
Steffca A/S – Falstervej 10 H – 5800 Nyborg – A/S Reg. Nr. 24 44 93 – CVR. Nr. 20 76 85 09
Telefon +45 6531 3102 – Telefax +45 6531 8502 - E-mail info@steffca.dk – www steffca.dk

Keramab N.V.
Haverheidelaan 4
B - 9140 Temse
Belgium
Telephone +32(0)3 711.02.78
Telefax +32(0)3 711.08.56

REFRACTORY FIBER PRODUCTS

Technical Datasheet

INSULFRAX® BLANKET



KERAMAB's latest addition to its fibres product range, **INSULFRAX®**, is a revolutionary breakthrough in insulating materials technology.

This new product is based on a calcium-magnesium-silica chemistry, giving excellent thermal and physical stability up to its operational limit of 1100°C.

INSULFRAX® products can be used in a wide range of applications as thermal insulation, particularly in Fire Protection and in Domestic Appliances.

General Characteristics

INSULFRAX® Blanket offers users a number of important advantages over other man-made mineral fibres:

- Excellent thermal and physical stability up to 1100°C
- Light weight, flexibility and exceptional acoustic absorption properties
- Improved tensile strength of **INSULFRAX®** Blanket due to our specialist manufacturing technology
- ***INSULFRAX®** needle felted Blanket contains no organic binders*

Chemical Analysis (wt.%)		
SiO_2	-	61.0 - 67.0
CaO	-	27.0 - 33.0
MgO	-	2.5 - 6.5
Al_2O_3	-	< 1.0
Fe_2O_3	-	< 0.6

Form:A1-050
Effective: 2905 1998/MJH.mvo
Supersedes: 0704 1998/MJH/mvo

Price List No.: III 016

KERAMAB
REFRACTORY & CERAMIC INNOVATION

Keramab N.V.
Haverheidelaan 4
B - 9140 Temse
Belgium
Telephone +32(0)3 711.02.78
Telefax +32(0)3 711.08.56

Technical Datasheet

Typical Applications

Domestic Appliances
- Boiler insulation
- Fire seals
- Storage heater insulation
- Wood-burning stove seals
- Domestic cooker insulation
- Chimney fill

Fire Protection
- Offshore rig accommodation modules
- Building expansion joints
- Column and beam wrap
- Fire door in fill

Typical Physical Properties		
Colour	-	Bluish-white
Classification Temperature	-	1100°C
Melting Point	-	>1330°C
Fibre Diameter	-	3.2 microns (mean)
Tensile Strength	-	> 35 kPa (128 kg/m³)

Thermal Conductivity Data, W/m°K (based on CEN draft method ASTM C-201)	64 kg/m³	96 kg/m³	128 kg/m³	160 kg/m³	192 kg/m³
200°C Mean Temperature	0.07	0.06	0.05	—	—
400°C Mean Temperature	0.10	0.09	0.08	0.07	0.06
600°C Mean Temperature	0.18	0.14	0.12	0.11	0.10
800°C Mean Temperature	0.27	0.22	0.18	0.16	0.15

Permanent Linear Shrinkage	1000°C	1100°C
24 hour soak	< 2.0 %	< 4.0%

Where appropriate Physical Properties and Thermal Conductivity Data measured according to ENV 1094-7:1994

Fire Test Data

INSULFRAX® Blanket is non-combustible in accordance with BS476:Pt4 and is approved for use against cellulosic and hydrocarbon fires and for dry wrapping of structural steel. Certification details can be supplied on request.

Form:A1-050
Effective: 2905 1998/MJH/mvo
Supersedes: 07041998/MJH/mvo

Price List No.: III 018

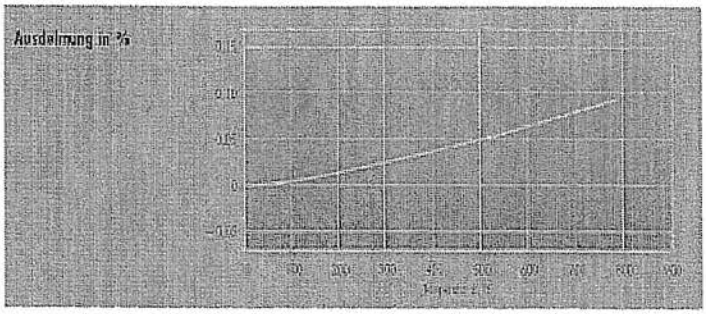
KERAMAB
REFRACTORY & CERAMIC INNOVATION

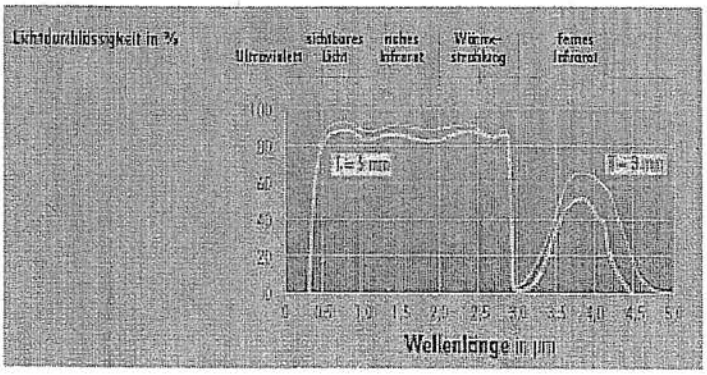
Glaskeramik NEOCERAM N-0
Technische Daten
Wärmeausdehnung
Lichtdurchlässigkeit

Oberflächenbeschaffenheit
Flache Scheiben/Beschichtete Glaskeramik/Einbaurichtlinien

Technische Daten

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





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

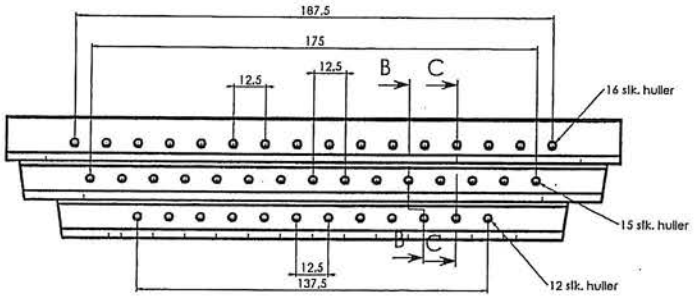
- SiO2 53-55 %
- Al2O3 14-15,5 %
- CaO - MgO 20-24 %
- B2O3 6,5-9 %
- Fe2O3-TiO2 < 1%
- Na2O-K2O < 1%

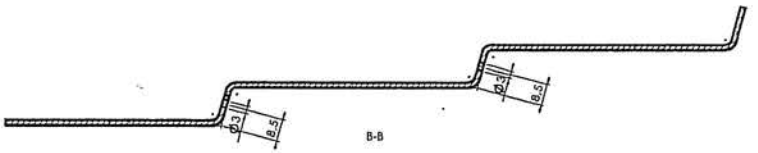
GENERAL PROPERTIES OF "E" GLASS FIBER

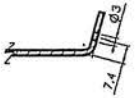
- Max. Temperature 550°C
- Melting Point 1200 °C
- Diameter-*filaments* 6-9 micron
- Tensile strength-*virgin filament* 3400 MPa
- Young's modulus 74000 MPa
- Thermal conducivity 1,0 W/m °K
- Fire reaction incombustible
- Loss on ignition < 1,5 %
- Dielectric rigidity-*glass in bulk* 60-100 KV/mm
- Solvent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

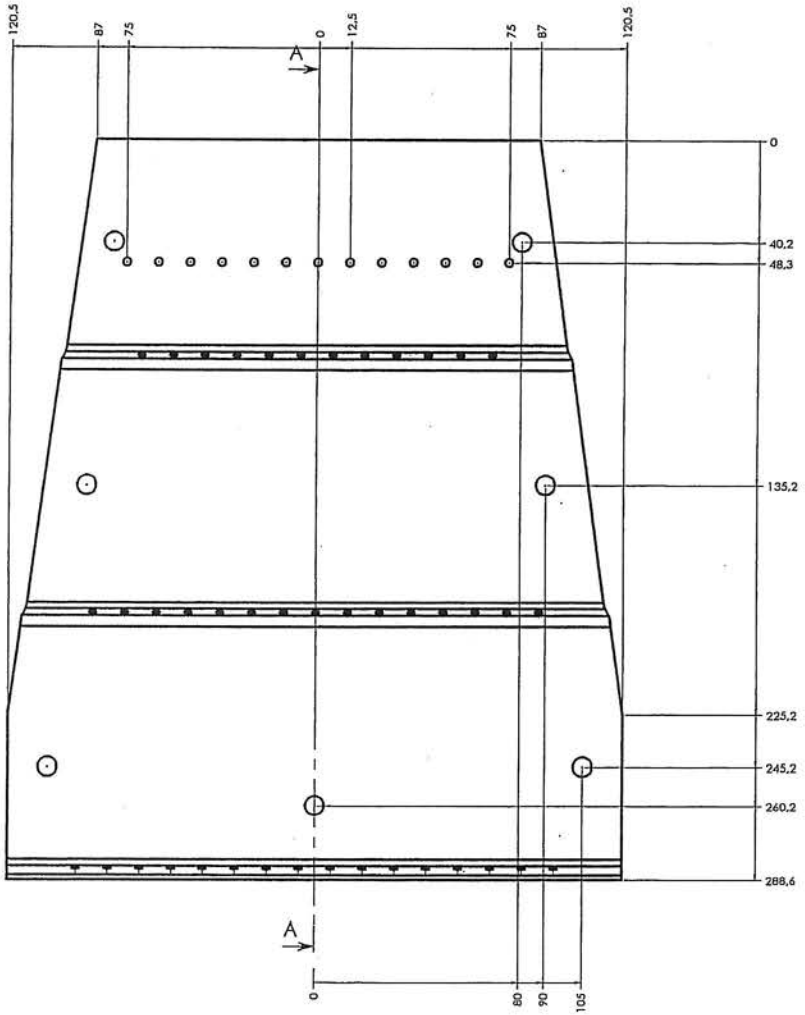
GENERAL PROPERTIES OF "E" GLASS FIBER TEXTILE PRODUCTS

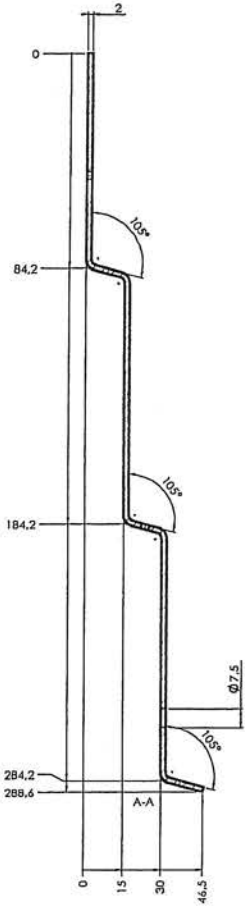
- - high mechanical strength - good electrical properties
- - incombustible - good dimensional stability
- - low thermal conducivity - good resistence to chemical agents
- - high thermal resistencs - - good flexibility
- - max temperature 550°C

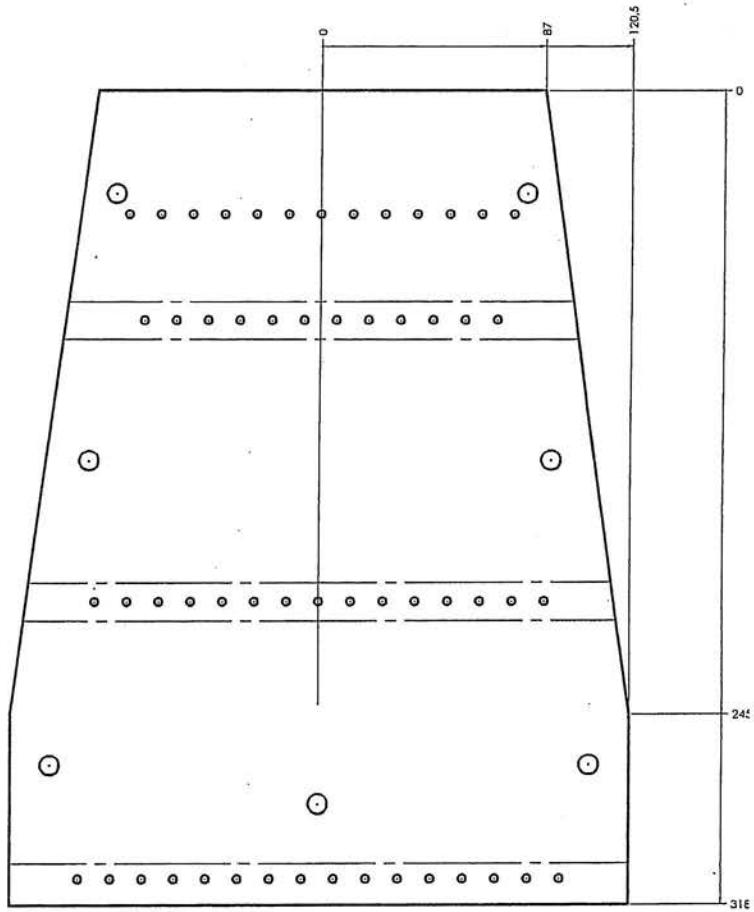










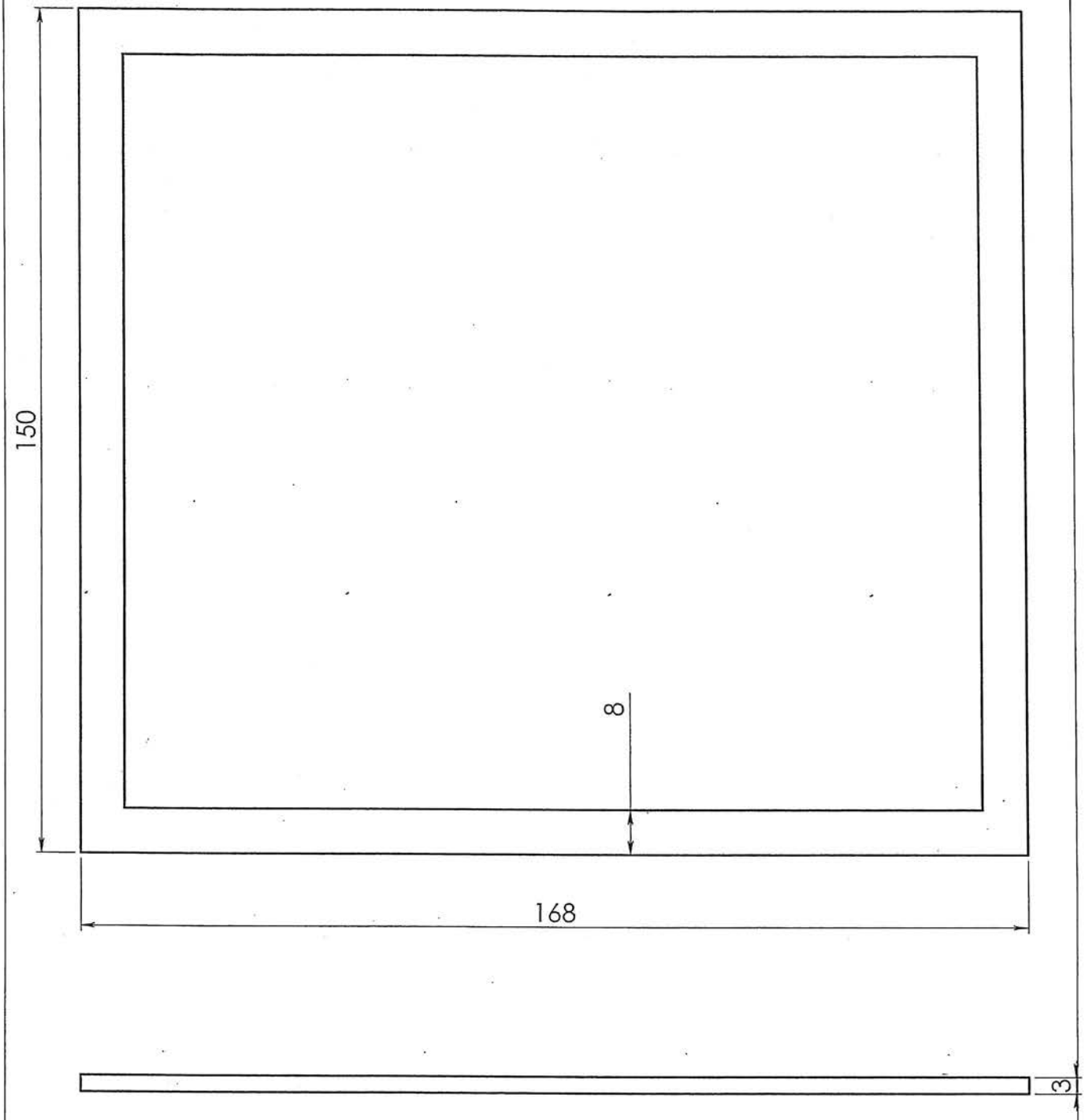


Udfoldet

Rev.	Revisions		
Title:	Rustfri røgledeplade	Construction:	
	2B Classic	Finish/coat:	
	Morsø 2B	Finish:	
Material:	Rustfrit stål	Scale:	
Weight:	1,117 kg	Pattern:	
Standard no.:	-	Drawing no.:	2B-1
Degree/system:	Enkeltegning		
Location of fin:			

morsø

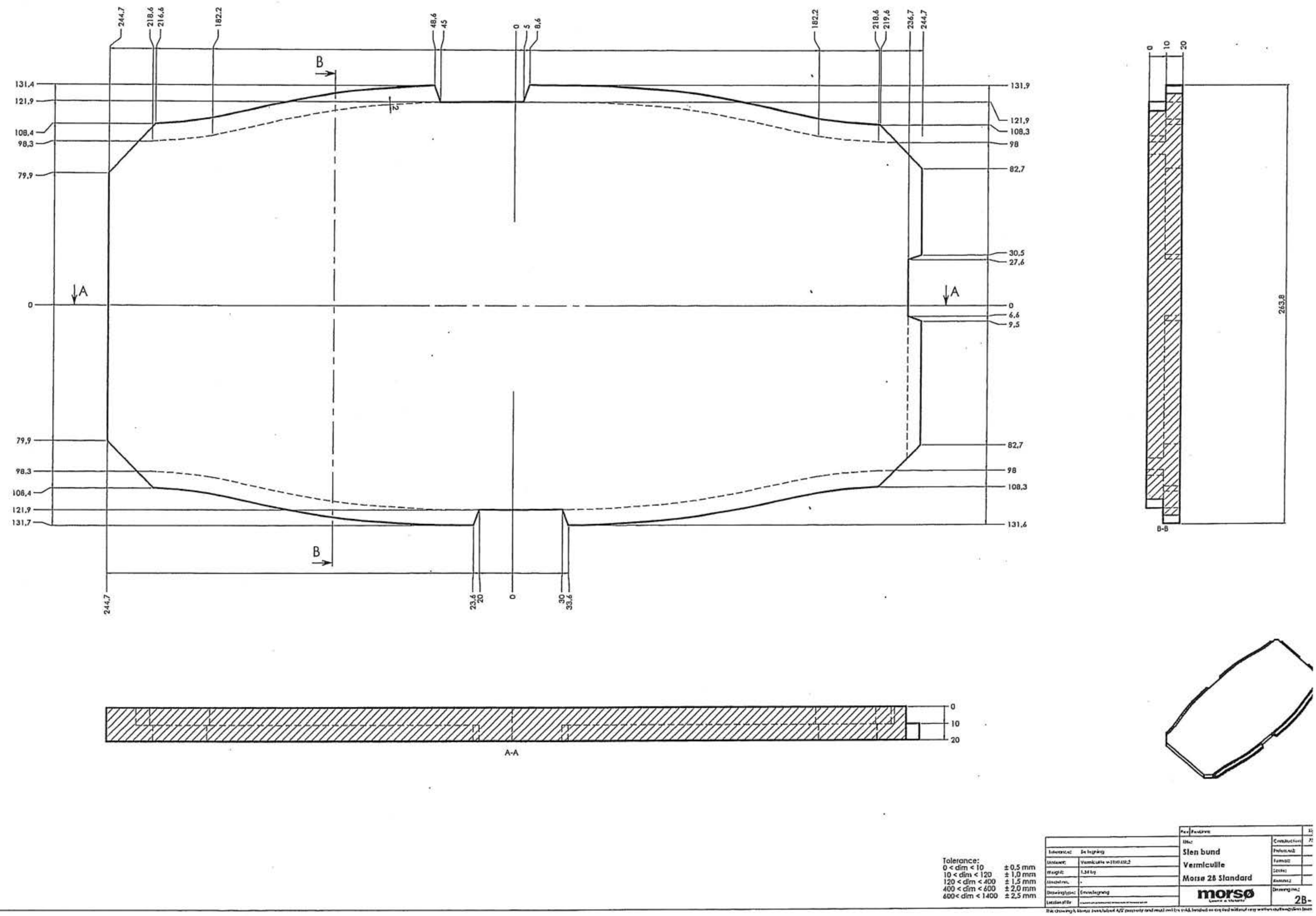
This drawing is Morsø Jernstøberi A/S' property and must not be used, handed on or copied without any written authorization from

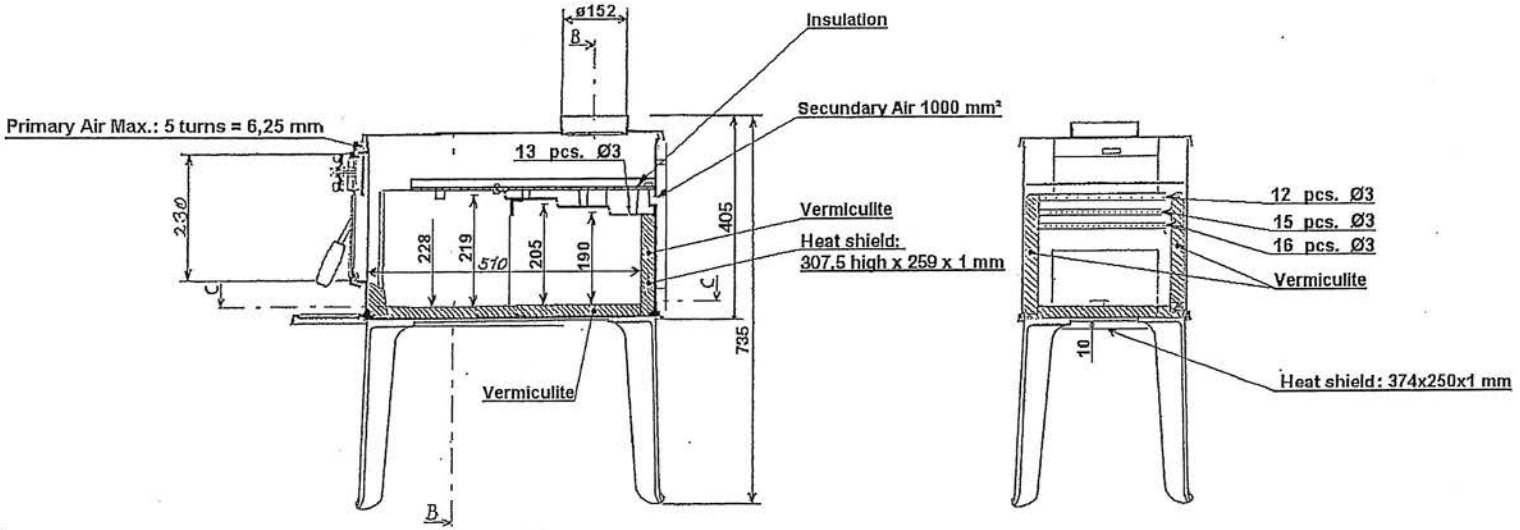


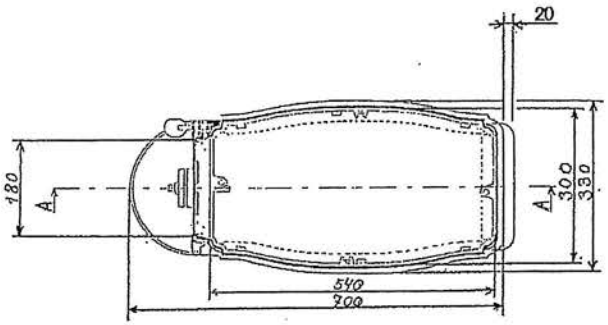
Rev.	Revisions	Sign.:	Date:

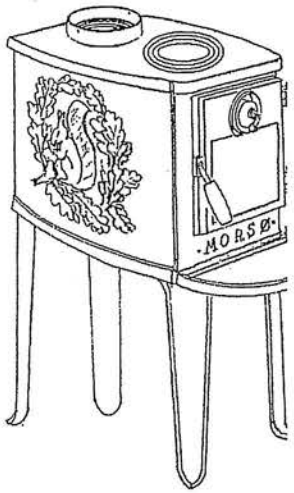
	Title:	Construction:	RSV	14.11.05
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	**Glasbånd 2B**	Released:		
Material: 8x4mm Glasbånd m. tape		Format:	A4	
Weight: 0,15 kg		Scale:	1:1	
Model no.	**Morsø 2B**	Itemno.:	79074500	
Drawingtype: Emnetegning	morsø By appointment to the Royal Danish Court	Drawing no.:	2B-94 a	
Location of file: U:\udv\Tegninger\188.2B\2B-94 Glasbånd 2B Classic.SLDPRT				

Date of print: 30-06-2006


A-A
B-B
263,8
Tolerance:
0 < dim < 10 ± 0,5 mm
10 < dim < 120 ± 1,0 mm
120 < dim < 400 ± 1,5 mm
400 < dim < 600 ± 2,0 mm
600< dim < 1400 ± 2,5 mm
Sten bund
Vermiculite
Morsø 28 Standard
morsø
2B-

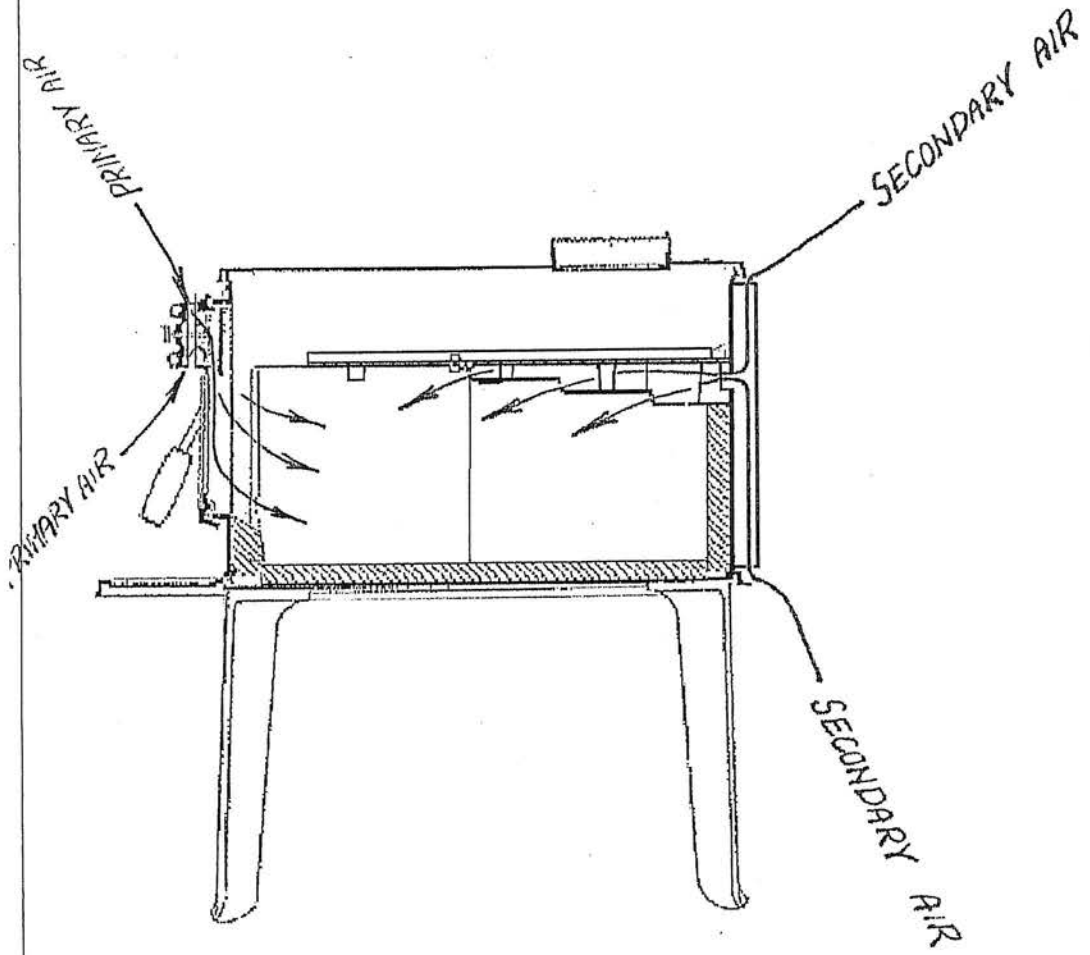


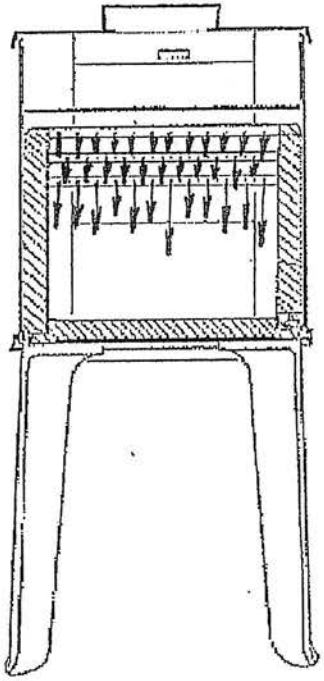




Rev.	Revision	Sign.	Dato	Godkendelsestegning	Sign.:	D
				2B Standard radiant NA	RSV	29.0
				Morsø **2B**	Tegn.form.: A3	Målf 1
				Filnavn: –	Varenummer:	
				morsø Jernstøberi A/S	Tegningsnummer: **2B-112 a**	

1-118 OF 1-50





Rev.	Revision	Sign.	Dato

Titel:
Air flow
2B Standard radiant
Morsø 2B

Filnavn:
—

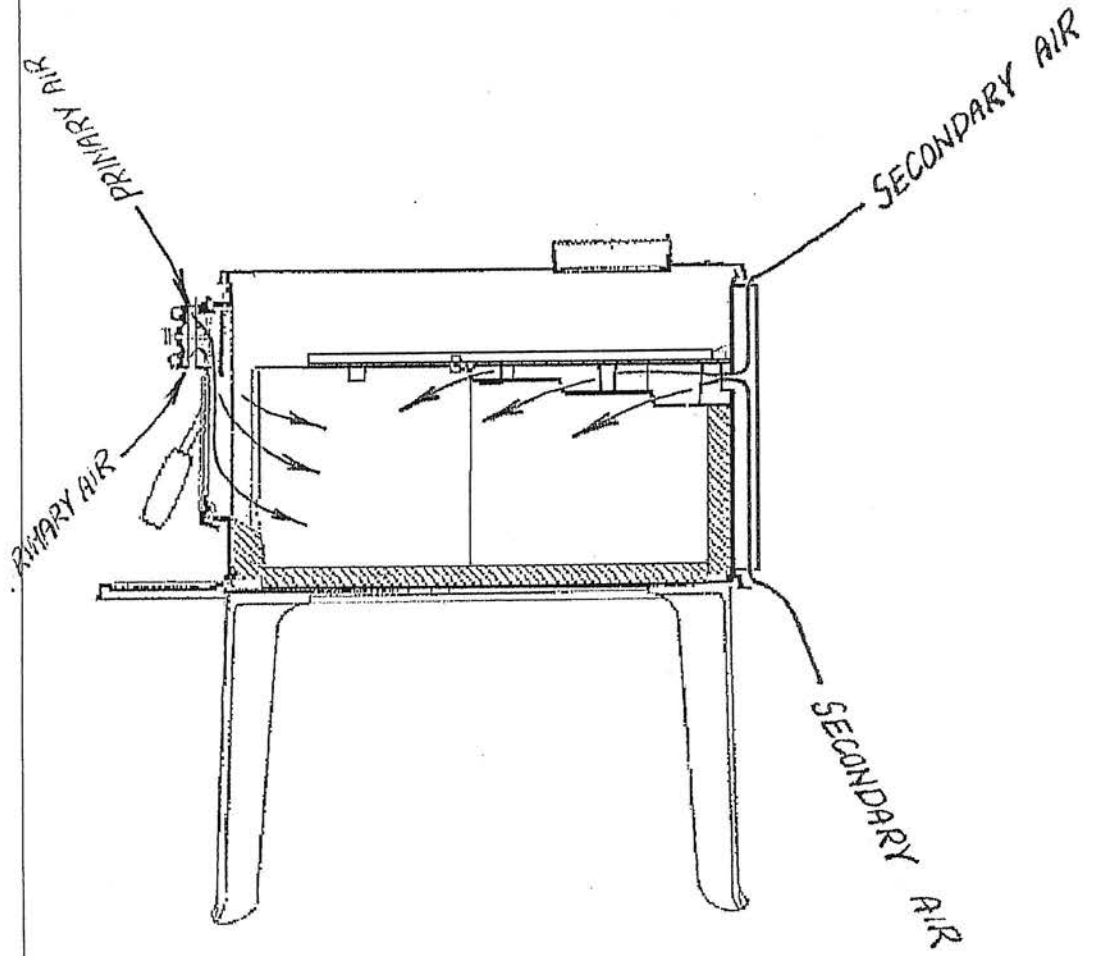
morsø
Jernstøberi A/S

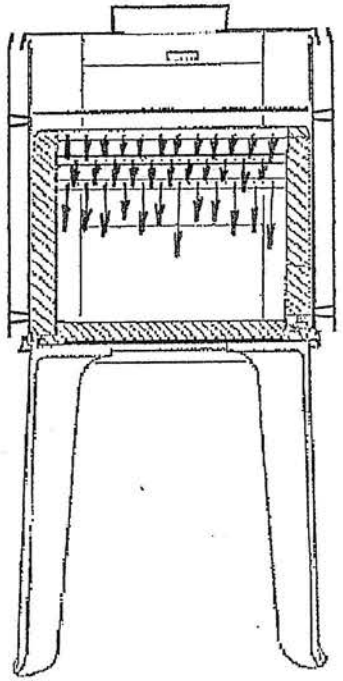
Sign.:	Dato:
RSV	30.06.200
Tegn.form.:	Målforhold
A3	1:10

Varenummer:

Tegningsnummer:
2B-113 a

1-19 OF 1-50





Rev.	Revision	Sign.	Dato

Titel:
Air flow
2B Standard conv.
Morsø 2B

Filnavn:
—

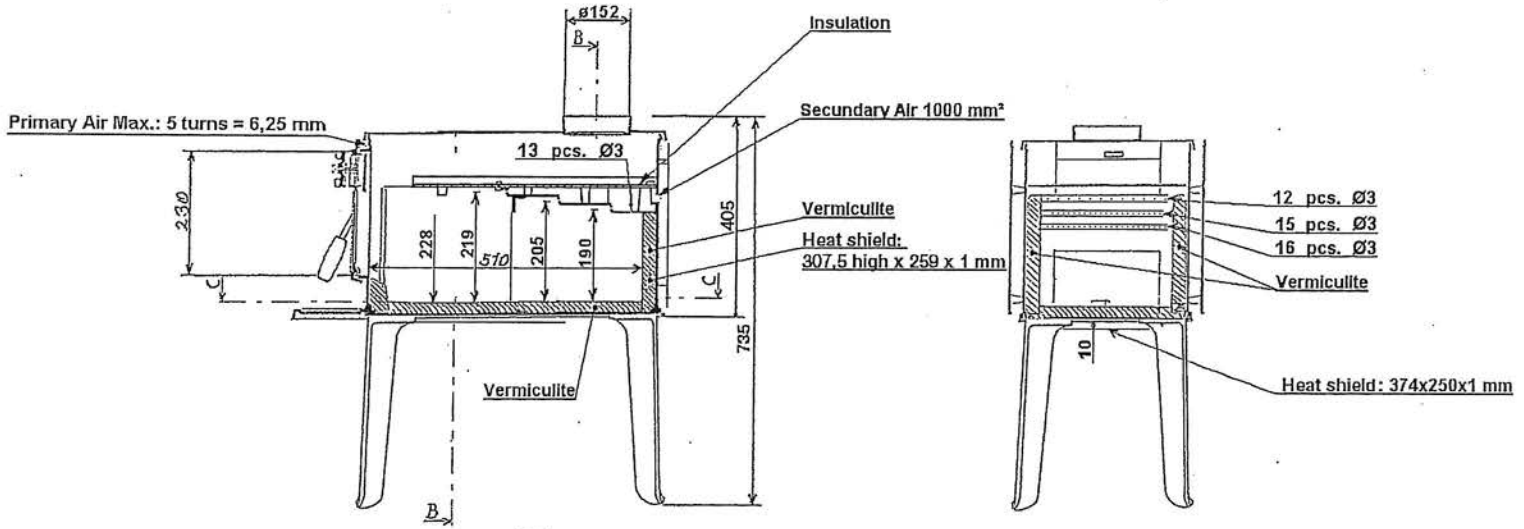
morsø
Jernstøberi A/S

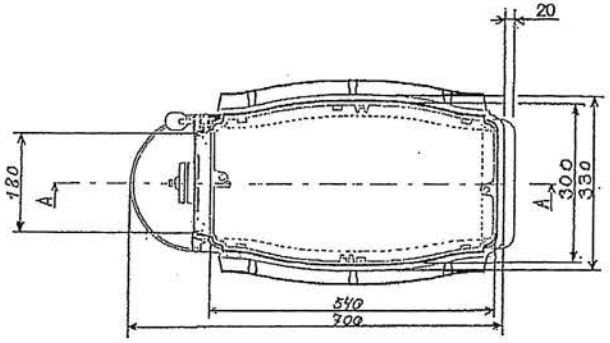
Sign.:	Dato:
RSV	**03.07.200**
Tegn.form.:	Målforhold
A3	1:10

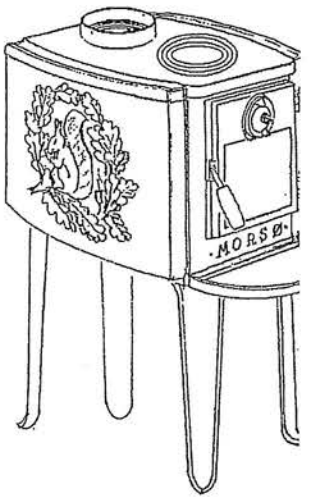
Varenummer:

Tegningsnummer:
2B-116 a

1 - 20 OF 1 - 50

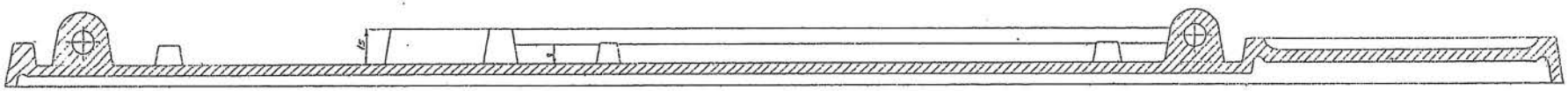




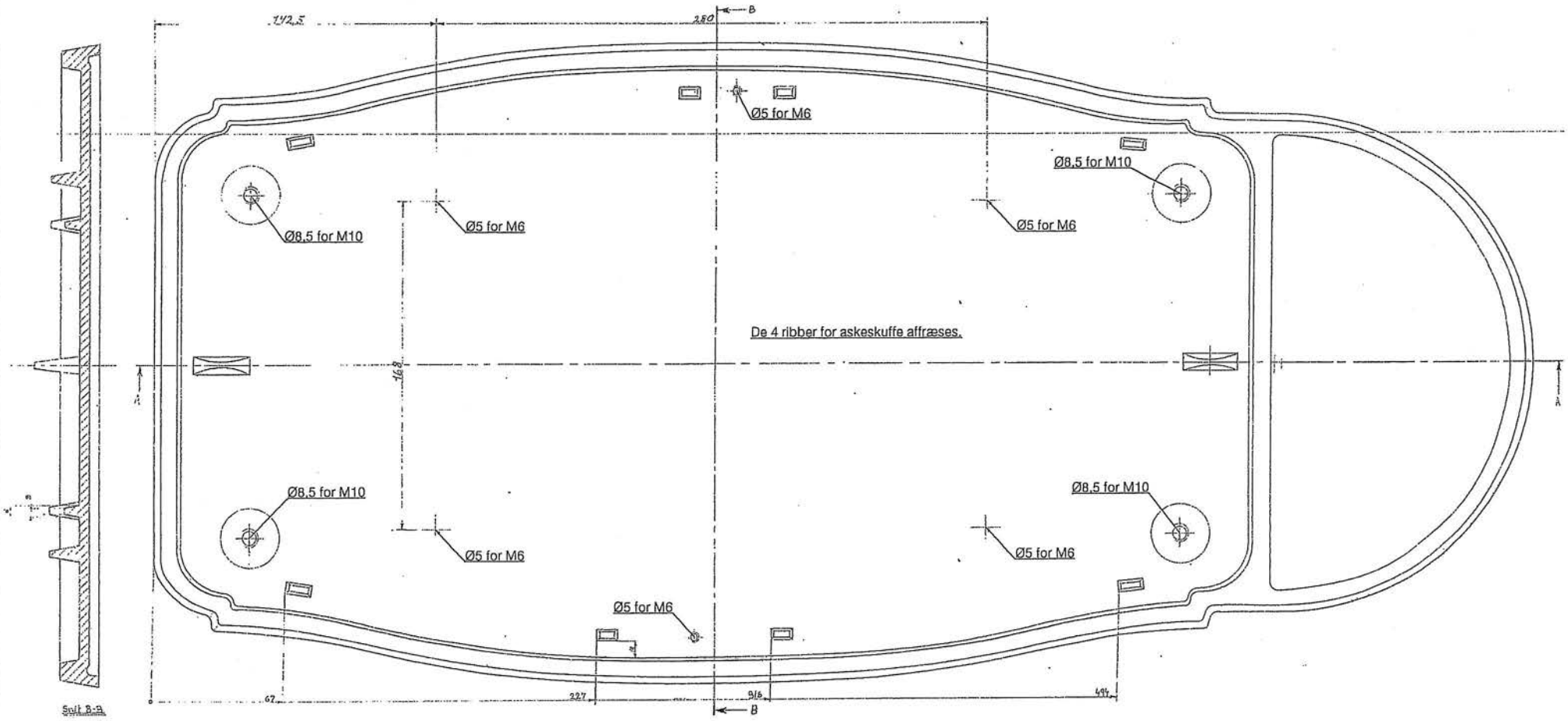


Rev.	Revision	Sign.	Dato	Godkendelsestegning	Sign.: RSV	D 03.0
				2B Standard conv. NA	Tegn.form.: A3	Målf 1:
				Morsø **2B**	Filnavn: –	Varenummer:
				morsø Jernstøberi A/S		Tegningsnummer: **2B-117**

1 - 21 OF 1 - 50



Snit A-A



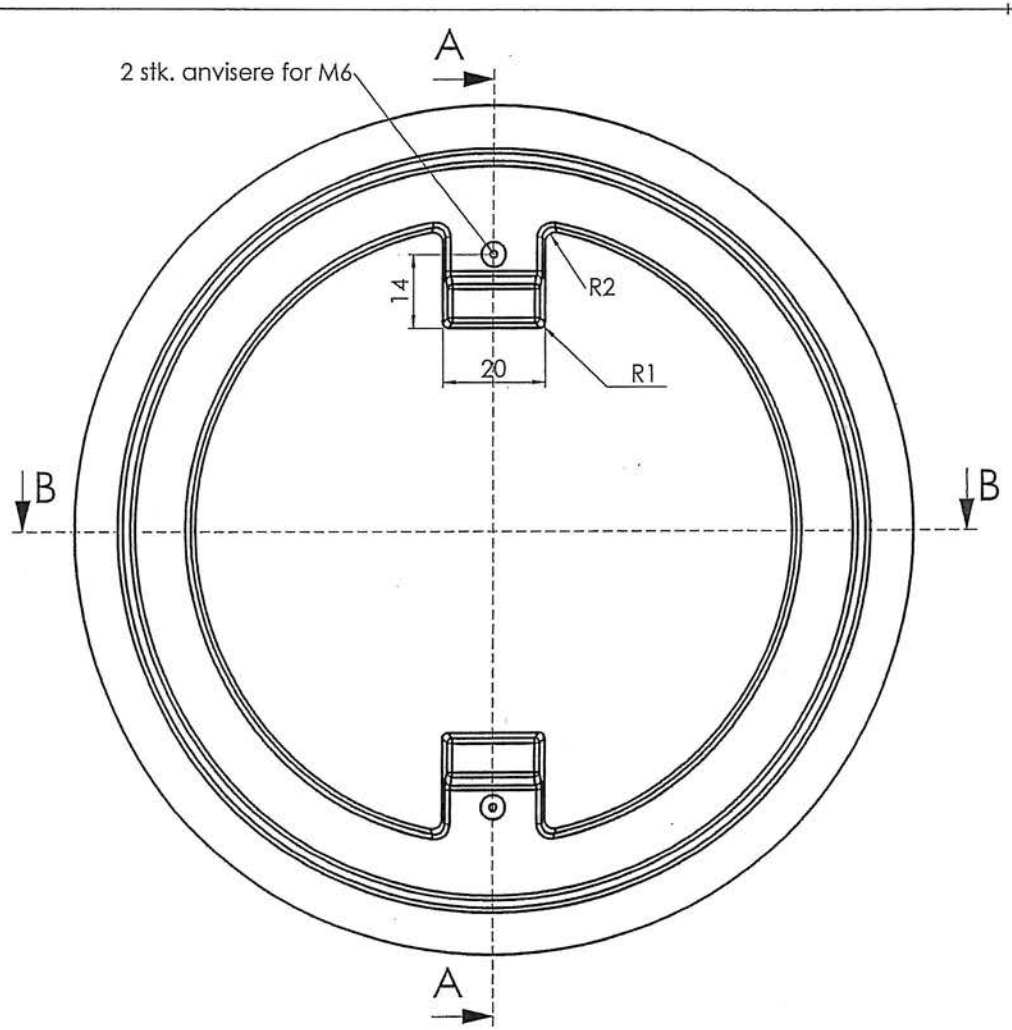
Snit B-B

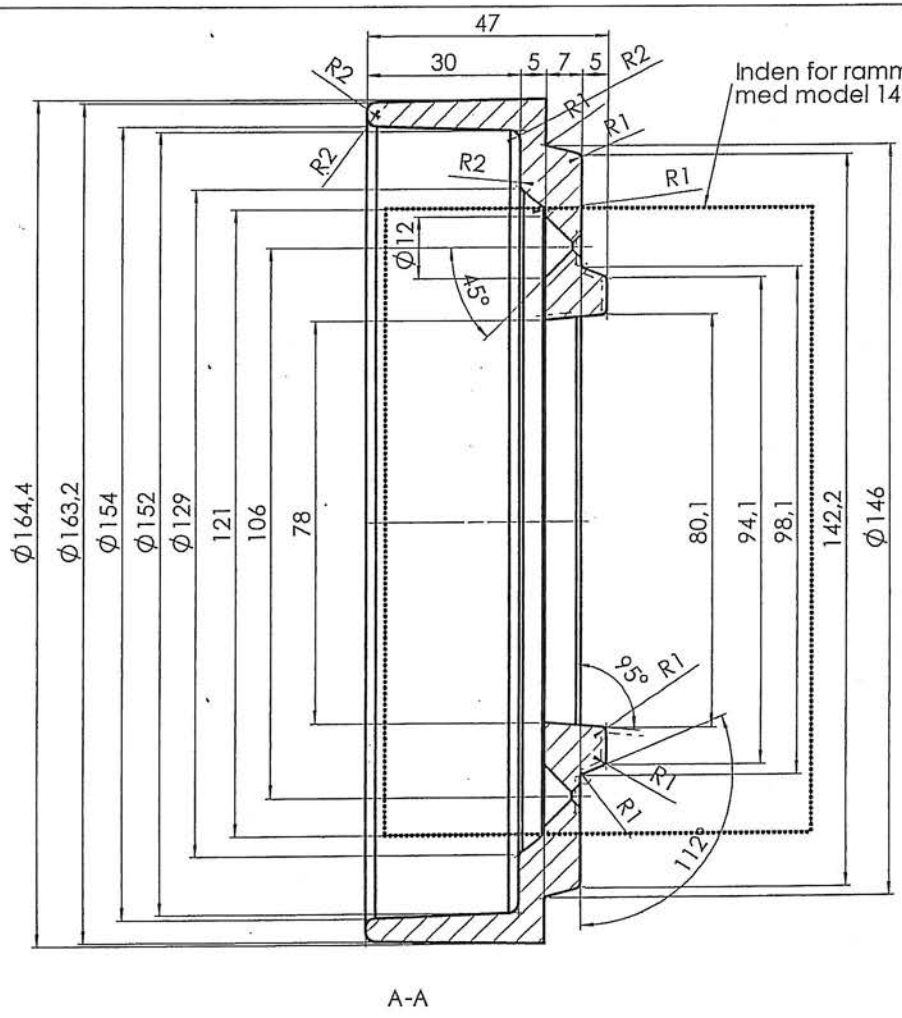
1 - 22 OF 1 - 50

Glip 10"

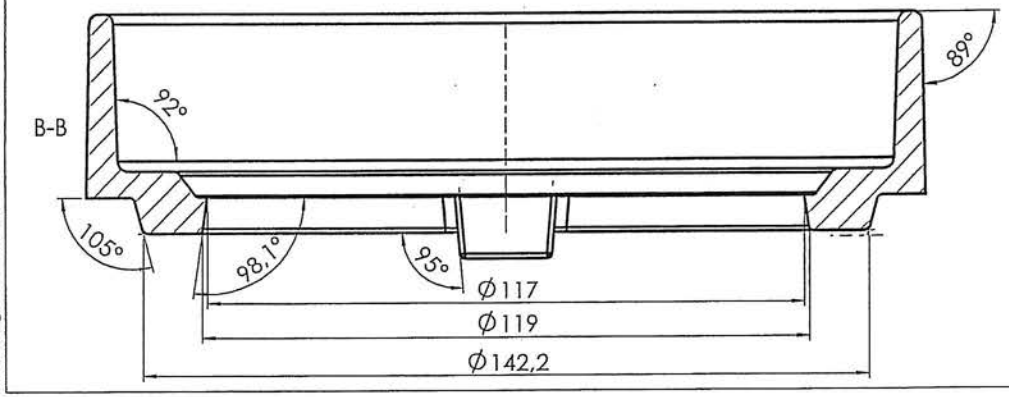
Rev.		Dato	Sign	Bundplade for 2BU. Boret og fræset		Scale 1:1
				N. A. Christensens & Co. MORSØ JERNSTØBERI Nykøbing Mors Tlf. (07) 72 13 00		Dwg. no. 2B-1

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





A-A



Rev.	Revisionstekst:	Sign.:	Dat

Materiale:	GG15		
Vægt:	1.22 kg	Bearbejdes:	
Overfladebeh.:			m²
Måltolerance:	Mål uden toleranceangivelse ISO-norm nr. 8062 CT8		
Ruhedstolerance:			
Værktøjsnr.:	Modelnr.: 1459		
Tegningstype:	Støbetegning		

Titel:
Røgtud USA

Morsø 1400

morsø

Konstr.:	RSV	13.12.
Frigivet:	RSV	24.09.
Tegn.format:	A3	
Målforhold:	1:1	
Varenr.:	3414590	
Tegningsnr.:	1400-219 a	

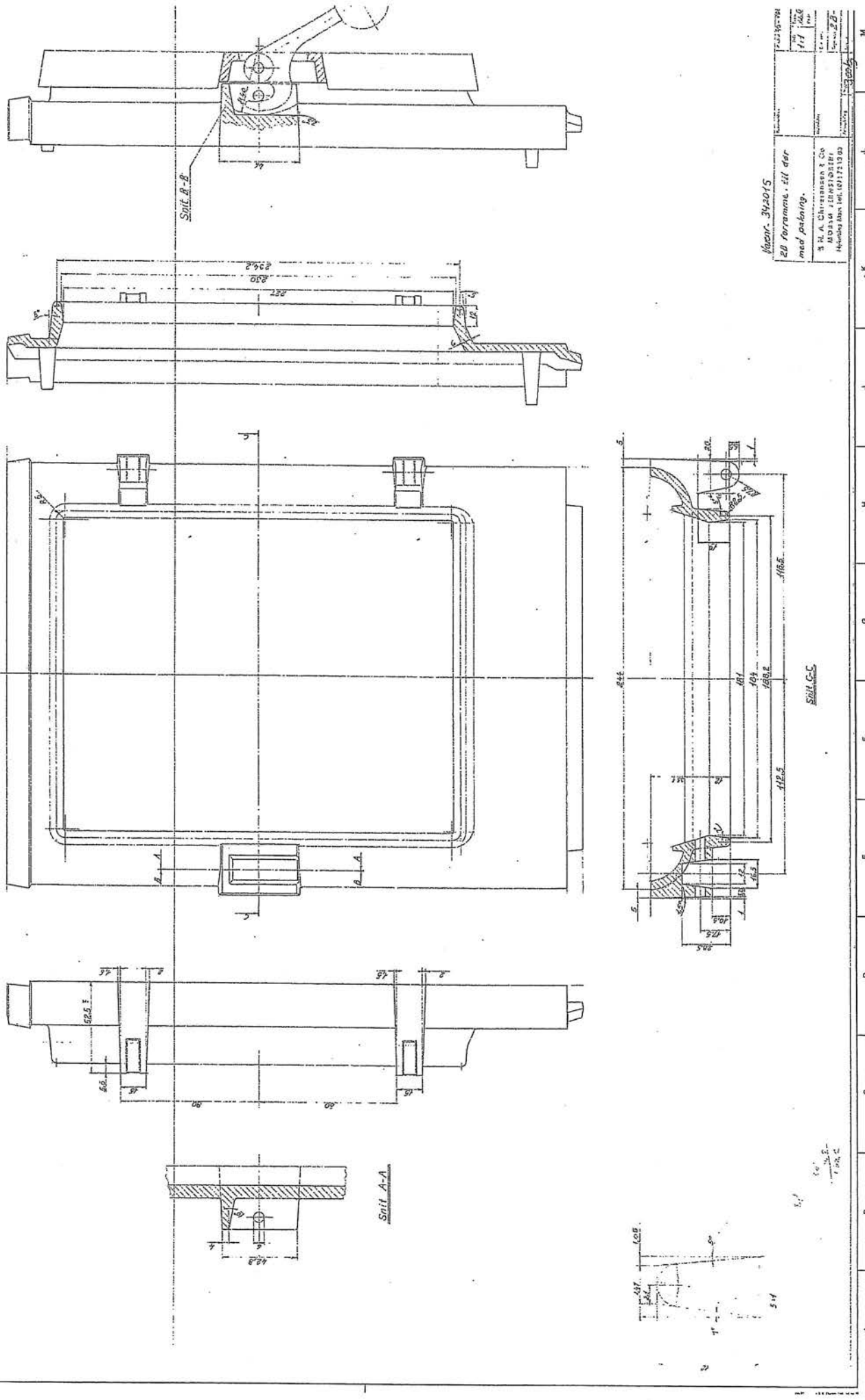
1400-219 røgtud usa - Sheet1

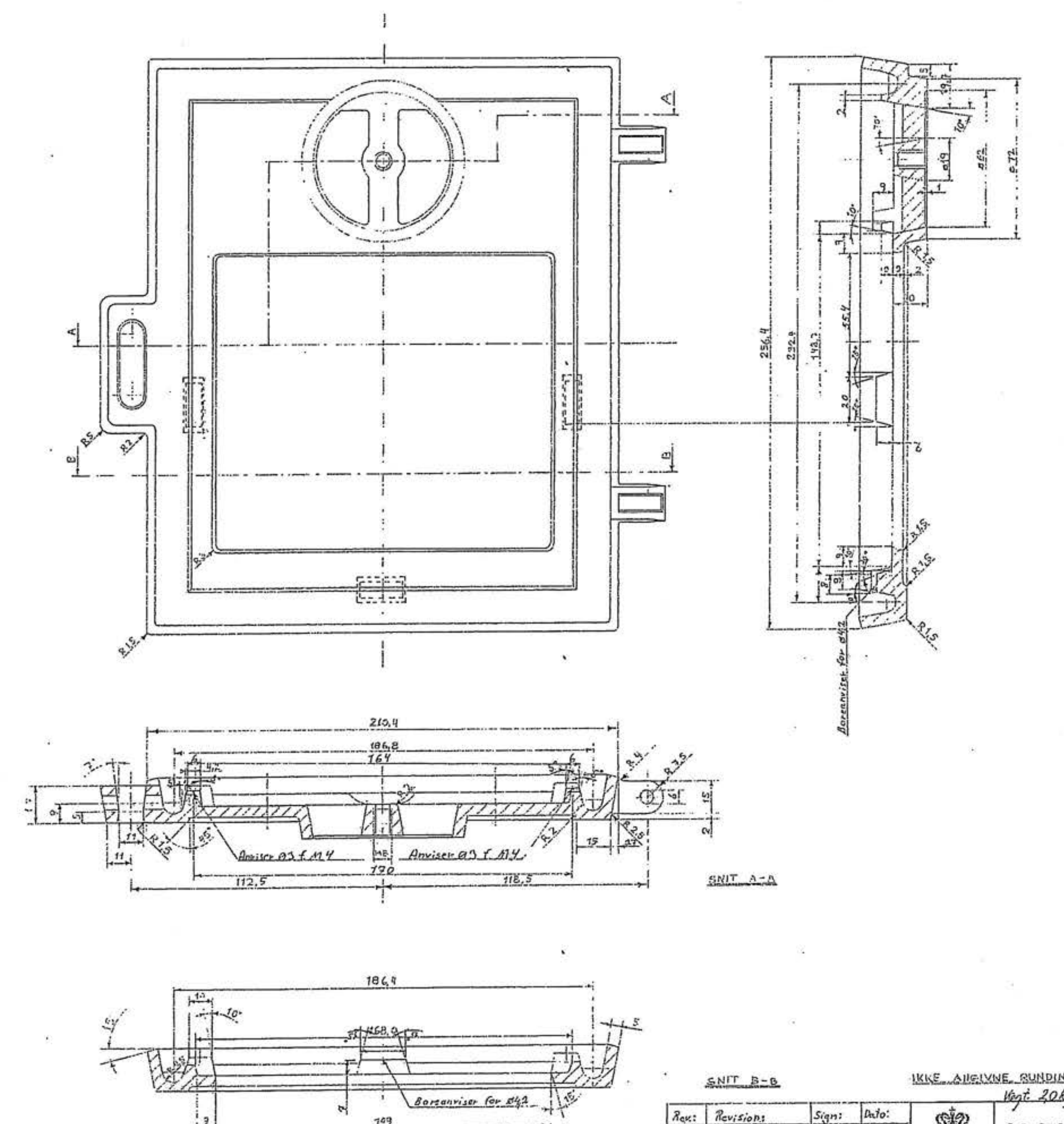
1 - 23 OF 1 - 50

Engineering Drawings/Blueprints (Remainder)

PARTS:	DRAWINGS:	DATE:
Front	2B-33	02.03.1983
Door	2B-59	25.10.2005
Door Glass	2B-64	14.11.2005
Radiation Shield - Base	2B-70	10.01.2000
Squirrel Side Panel	2B-71	No date
Horizontal Baffle	2B-82	12.09.2005
Rear Plate	2B-83	17.05.2005
Vertical Baffle	2B-84	12.05.2005
Baffle - standless steel	2B-85	12.09.2005
Side Brick	2B-87	02.11.2005
Rear Brick	2B-88	02.11.2005
Insulation	2B-90	15.09.2005
Tightening tape	2B-94	14.11.2005
Radiation Shield - Front	2B-95	04.11.2005
Air Controle	2B-96	15.11.2005
Smoke Valve	2B-102	16.11.2005
Radiation Shield - Back	2B-108	03.07.2006
Top - upper part	2B-110	28.06.2006
Brick - Bace	2B-111	28.06.2006
App. drawing 2B Standard radiant	2B-112	29.06.2006
Air flow 2B Standard radiant	2B-113	30.06.2006
Leg	2B-114	03.07.2006
Konv. Side Panel	2B-115	03.07.2006
Air flow 2B Standard conv.	2B-116	03.07.2006
App. drawing 2B Standard conv.	2B-117	03.07.2006
Base	2B-118	05.07.2006
Glass Fittings	1124-29	23.02.1993
Clasp	1400-42	01.04.1996
Bakelite Handle 72 mm	1400-193	23.03.2004
Fitting for Cover w. thread	1400-204	03.03.2000
Flue Collar	1400-219	24.09.2001
Fitting for Handle	1400-227	23.03.2004
Hinge Pin	2100-174	26.01.2004
Poker	9000-05	11.06.1999

V-1100 (600) Vermiculite insulating slabs- Technical datas
Glas fiber products – Technical datas
Glass ceramics - Technical datas
Installation and Operating Instructions
Parts list 2B Classic


Snit B-B
Snit C-C
Snit A-A



IKKE ANGIVNE RUNDINGER: R 1

Vægt 20 kg Varenr 342034

Rev:	Revisions:	Sign:	Dato:
b	Påført 3 knaster	RSV	25.10.2...
C	Ændret 2 knaster —"— og tilføjet 2 ...	RSV	01.02.20..

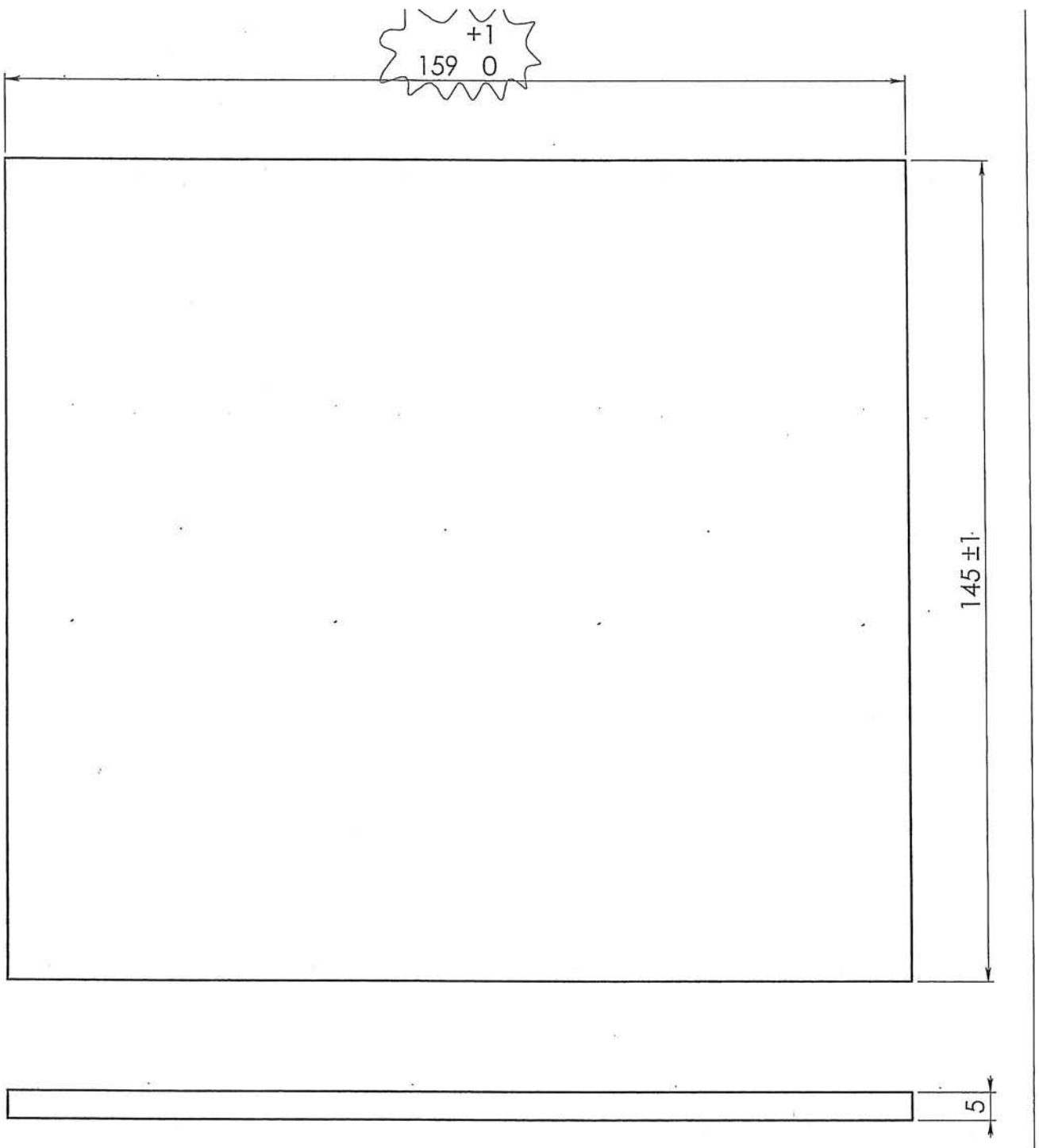
morsø

2 B DØR M. GLAS

(Ændring af eksist. model)

DATO 20.01.88 · MÅL 1:1 · ÆNDRET · MODELNR. ..20 · TEGNINGSNR. 2.8-5.8

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



Rev.	Revisions	Sign.:	Date:
e	Ændret breddemålet for 2B Classic	RSV	15.11.05
d	Ændret tolerancer.	RSV	13.03.97
c	Filnavn rettet.	RSV	28.01.97
b	Gamdrup Tegne teknik	HCH	April 96

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

Material:	Keramisk glas
Weight:	0,29 kg
Model no.	
Drawingtype:	Emnetegning
Location of file:	U:\vdv\Tegninger\188.28\28 Glas.SLDPRT

Title:

Glas til

2B Classic

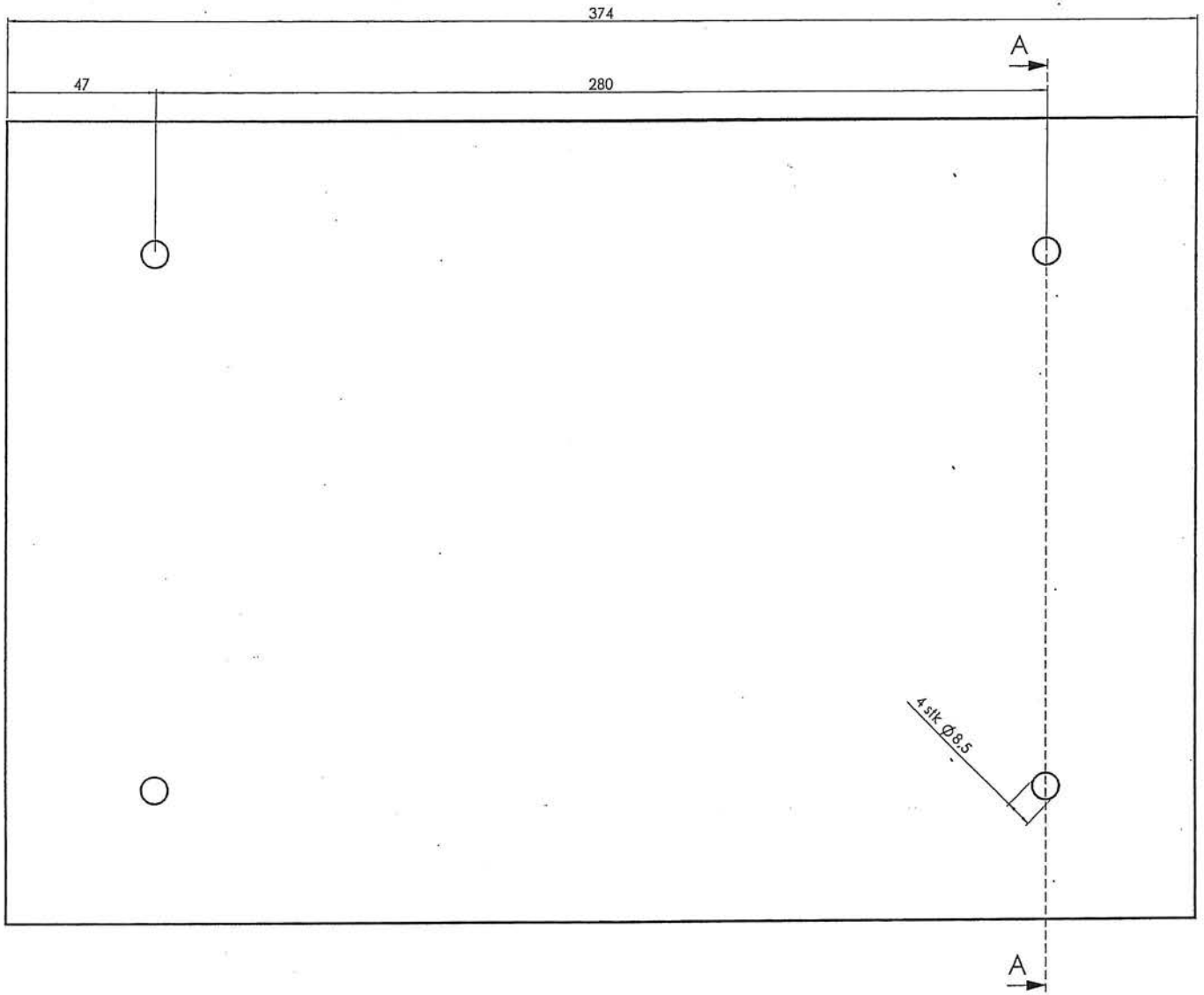
Morsø 2B

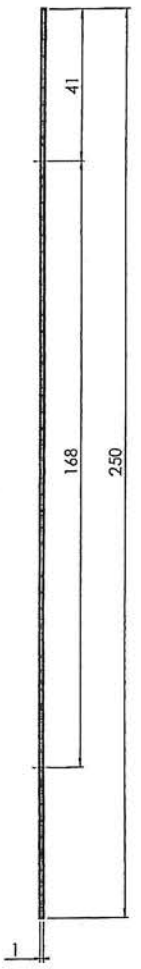
morsø

By appointment to HM the King of Denmark

Construction:	Aa.GJ	12.02.93
Released:		
Format:	A4	
Scale:	1:1	
Itemno.:	790715	
Drawing no.:	2B-64 e	

Date of print: 30-06-2006

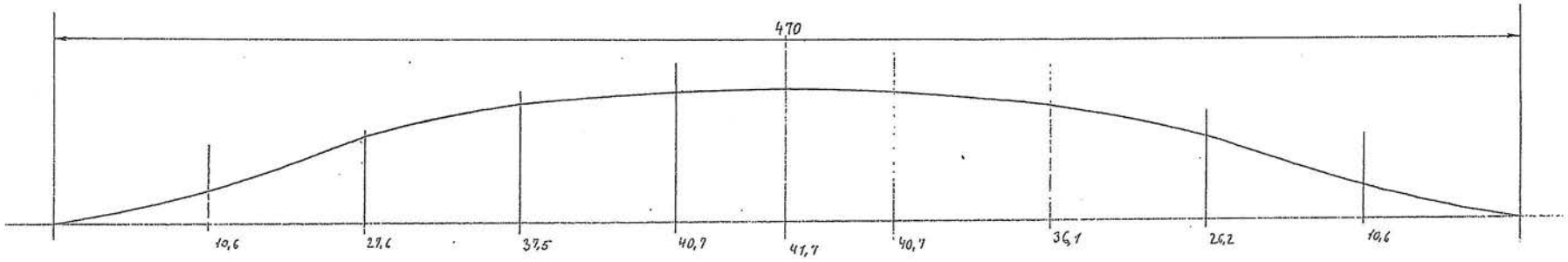


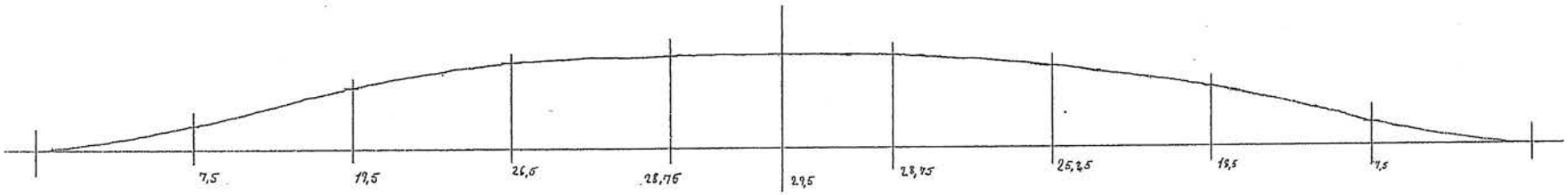


A-A

			Rev.	Revisionstekst:	Sign.:
Materiale:	1 mm varmgalv. plade		Titel:		Konstr.: RSV
Vægt:	0,75 kg.	Bearbejdes:	Stråleplade		Frigivet:
Overfladebeh.:		m²	Bund		Tegn.format: A
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m		2B		Målforhold: 1
Ruhedstolerance:			morsø		Varenr.: 5413
Vandretjnr.:					Tegningsnr.: 2b-70
Tegningstype:	Emnetegning				

2b-70 stråleplade bund 2B - Stræk1



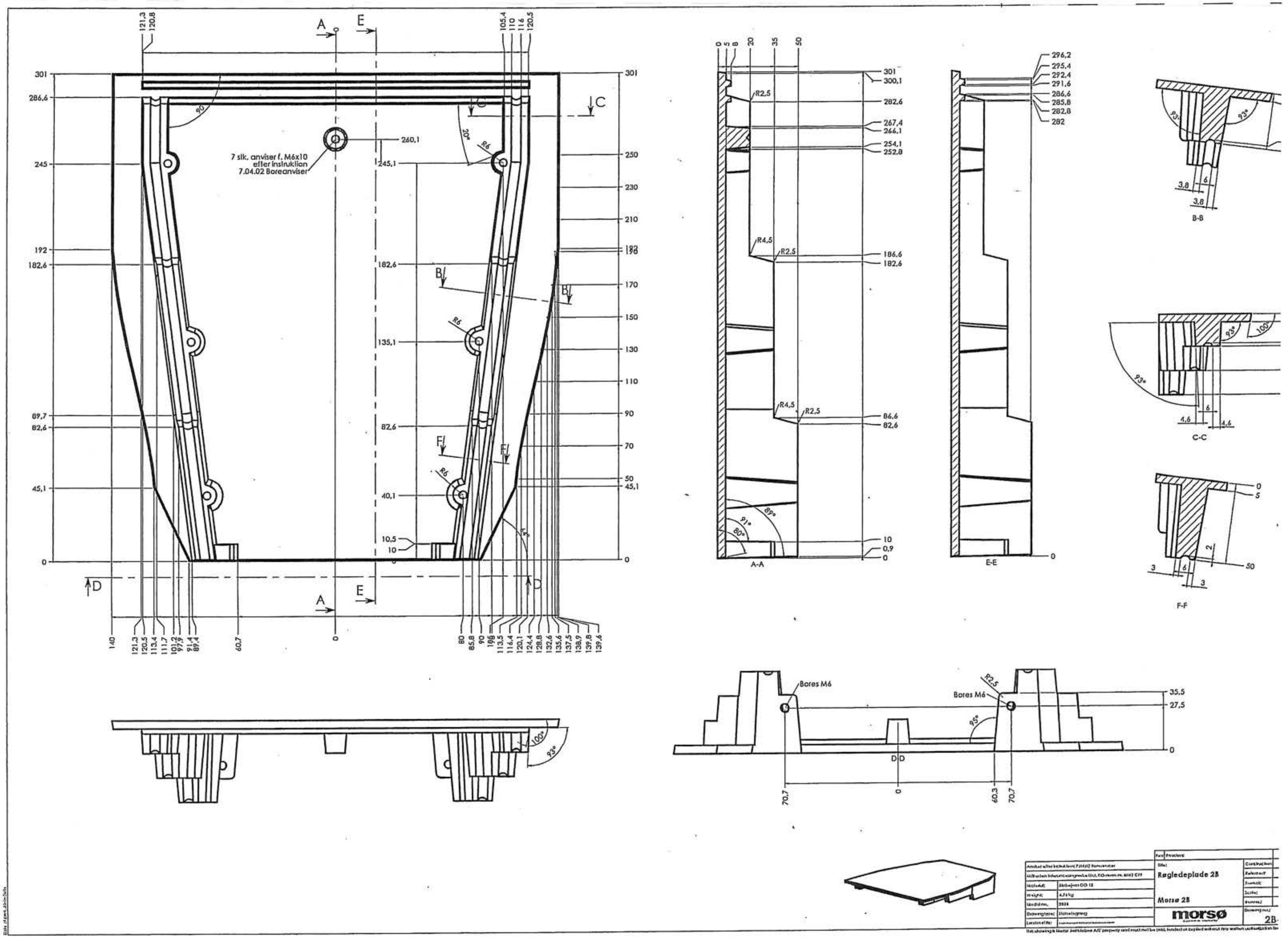


Side 2B m/radier

2B-71

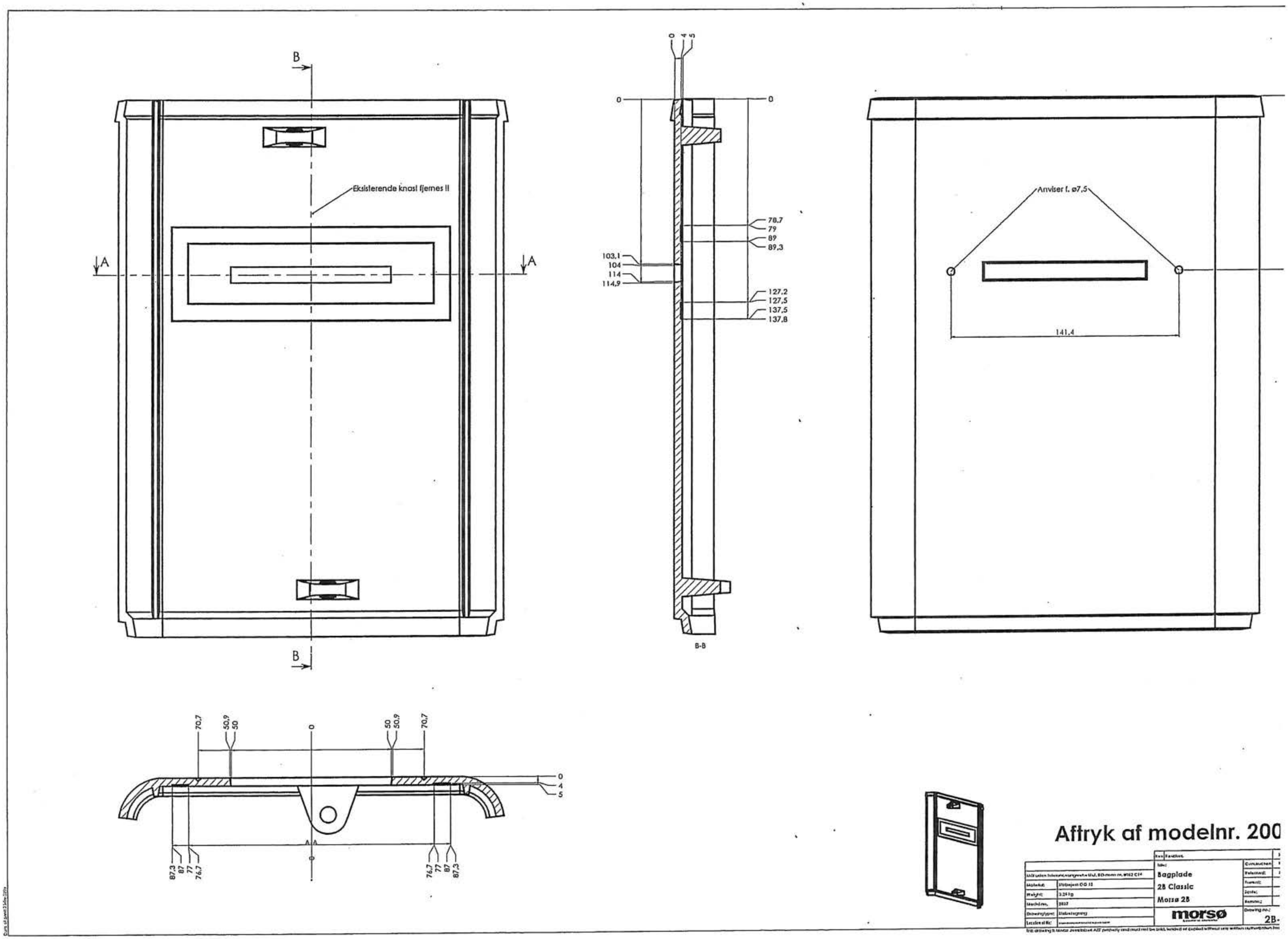
1-30 OF 1-50

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

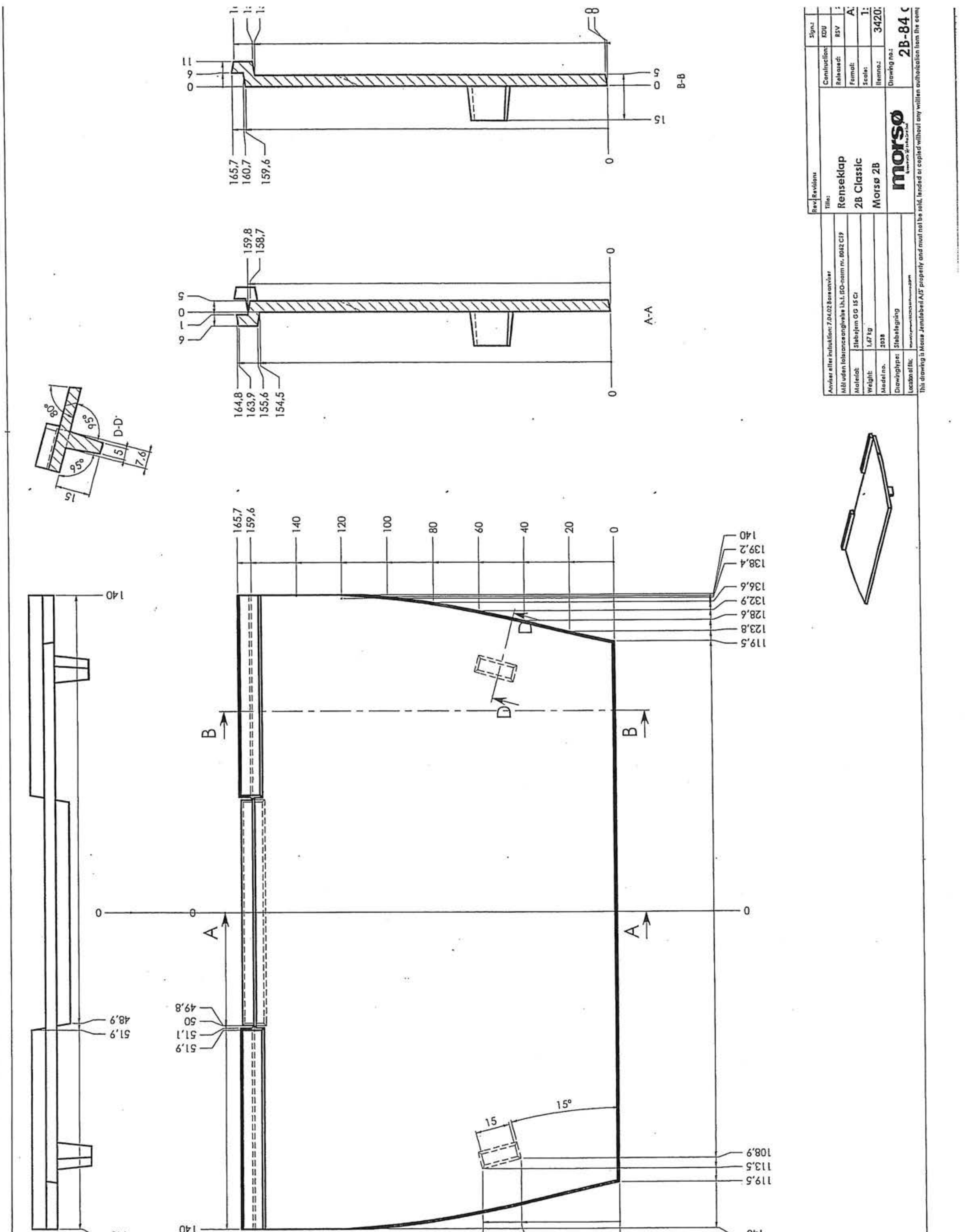


7 stk. anviser f. M6x10 efter instruktion 7.04.02 Boreanviser
A-A
E-E
B-B
C-C
F-F
D-D
Bores M6
Bores M6
Røgledeplade 2B
Morsø 28
morsø
2B

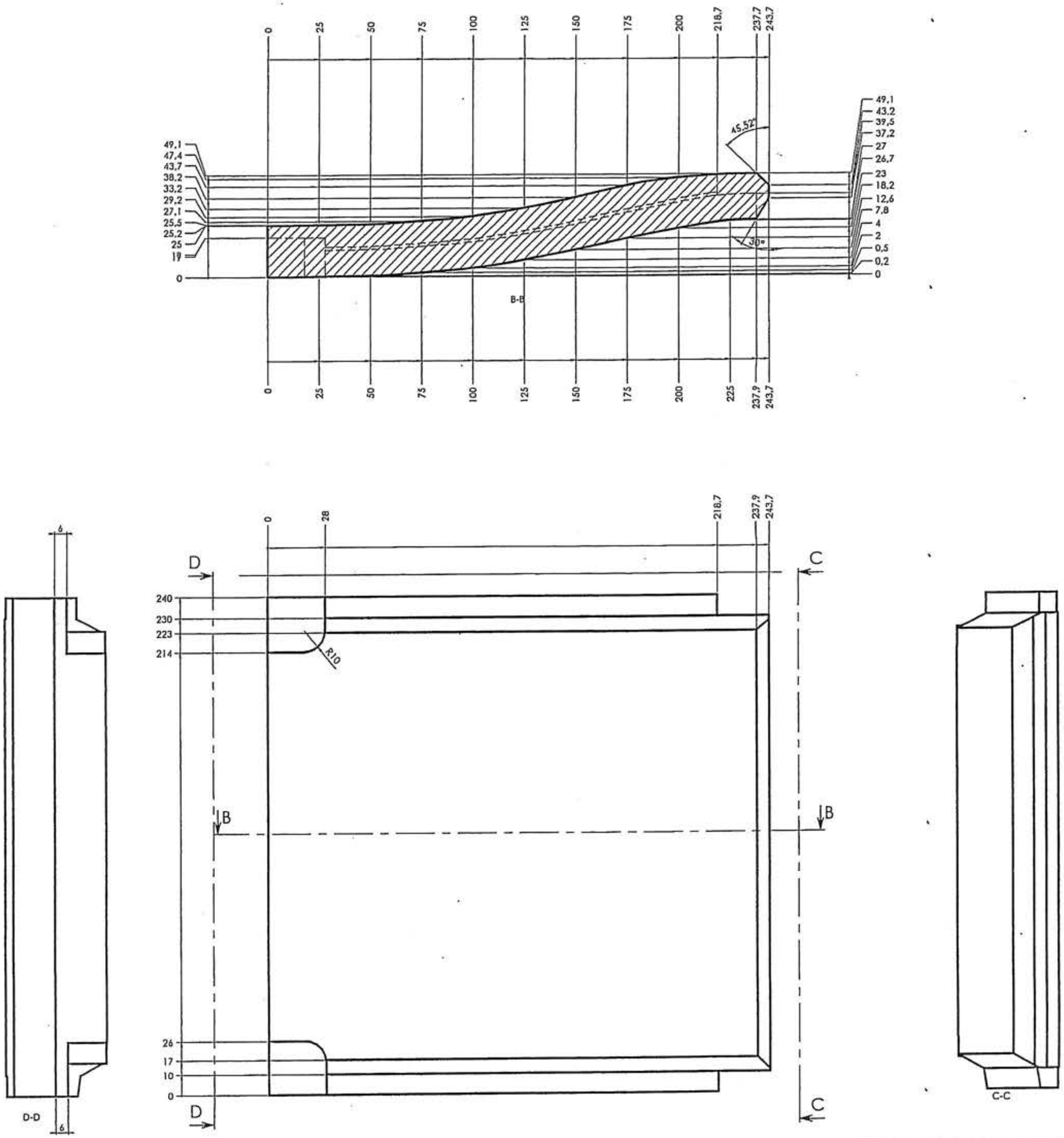
1-31 OF 1-50

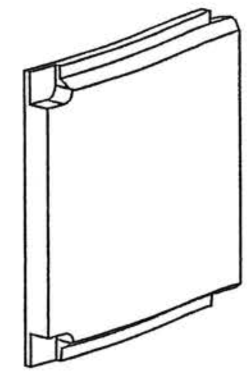

Aftryk af modelnr. 200
Eksisterende knast fjernes !!
Anviser f. ø7,5
141,4
B
A
B-B
A-A
0
4
5
78,7
79
89
89,3
103,1
104
114
114,9
127,2
127,5
137,5
137,8
70,7
50,9
50
76,7
77
87
87,3
Bagplade
2B Classic
Morsø 2B
morsø
2B-

1 - 32 05 1 - 50



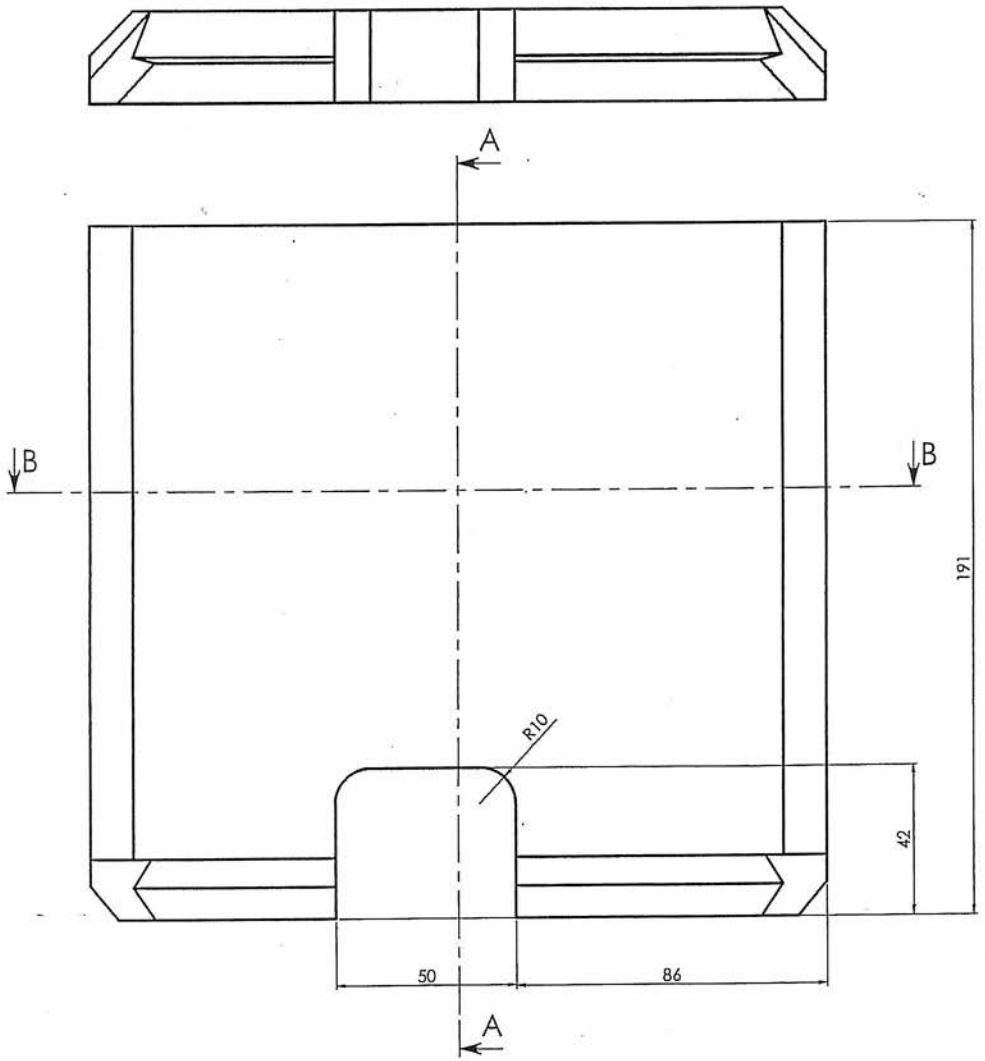
Renseklap
2B Classic
Morsø 2B
Materiale: Støbejern GG 15 Cr
Weight: 1,67 kg
Model no.: 2038
Drawingtype: Støbetegning
Construction: KDU
Released: RSV
Drawing no.: 2B-84
A-A
B-B
D-D

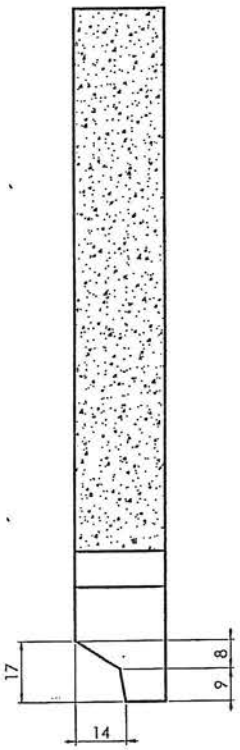




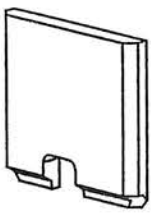
Tolerance:
0 < dim < 10 ± 0,5 mm
10 < dim < 120 ± 1,0 mm
120 < dim < 400 ± 1,5 mm
400 < dim < 600 ± 2,0 mm
600< dim < 1400 ± 2,5 mm

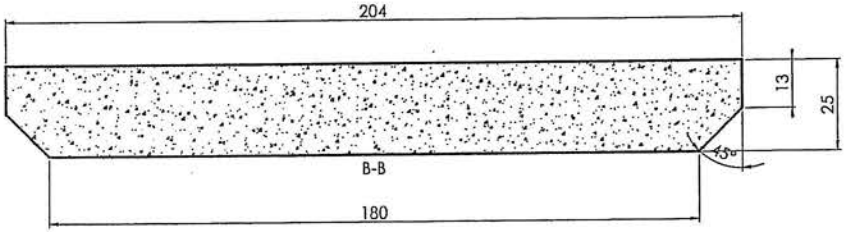
	Se tegning	Title: Sten side 28 Vermiculite Morsø 28
Material:	Vermiculite [illegible]	
Weight:	0,91 g	
Model no.:	-	
Drawing type:	Emnetegning	morsø
	[illegible]	Drawing no.: 2B-





A-A



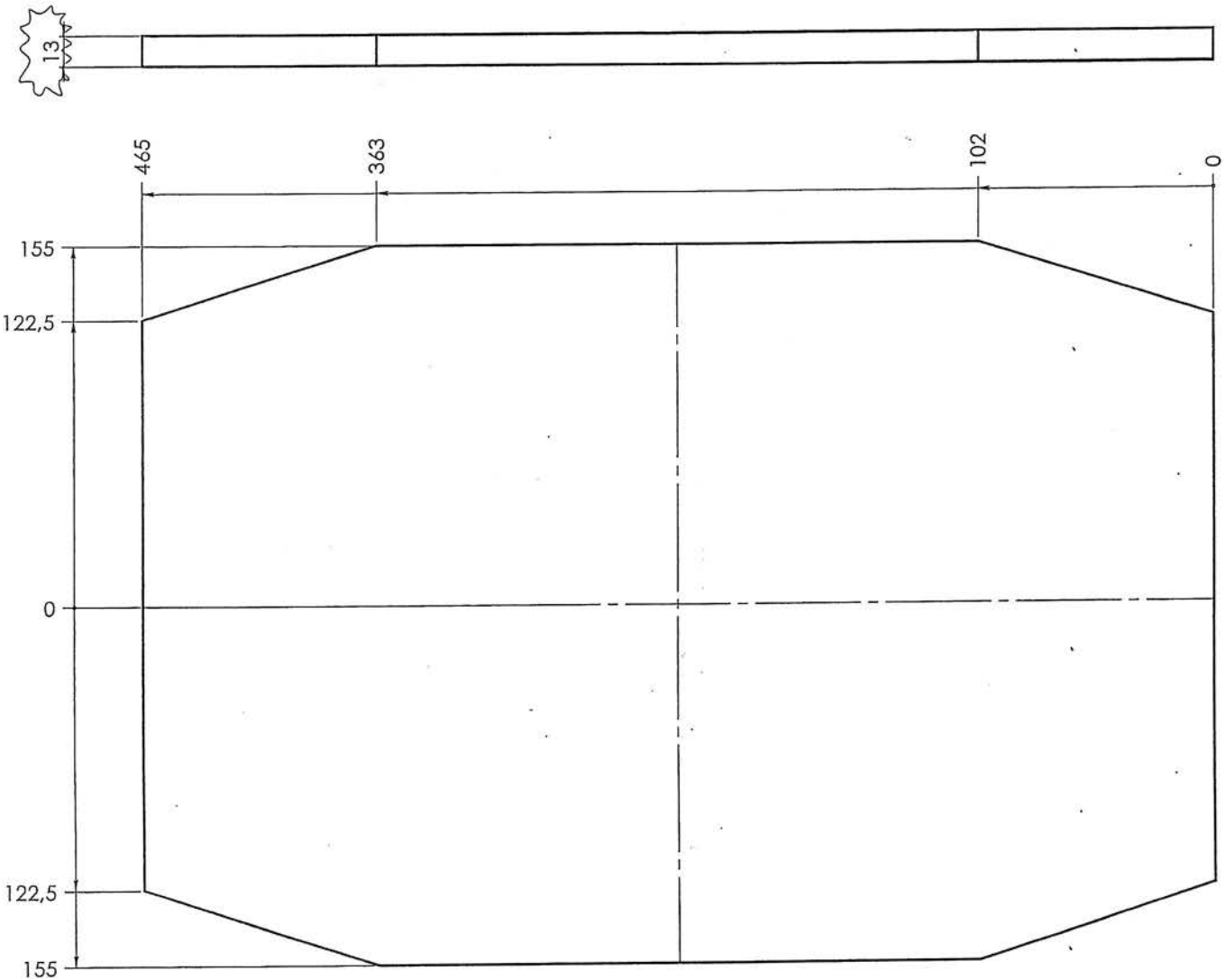


Tolerance:

0 < dim < 10	± 0,5 mm
10 < dim < 120	± 1,0 mm
120 < dim < 400	± 1,5 mm
400 < dim < 600	± 2,0 mm
600< dim < 1400	± 2,5 mm

Tolerance:	Se tegning
Material:	Vermiculite v-1100 Mk.2
Weight:	0,52 kg
Model no.	-
Drawingtype:	Emnetegning
Location of file:	

Rev.	Revisions	Sign.:
Title:		Construction: KDU
Sten bag 2B		Released: RSV
Vermiculite		Format: A
Morsø 2B		Scale: 1:
		Itemno.: 7920
morsø		Drawing no.: 2B-88



b	Ændret tykkelsen fra 10 mm til 13 mm.		RSV	07.02.
Rev.	Revisions		Sign.:	Dat
		Construction:	KDU	12.09
		Released:	RSV	03.02.2
		Format:	A3	
		Scale:	1:2	
		Itemno.:	7907710	

Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	
Material:	Isa glas (Therm's)
Weight:	
Model no.	-
Drawingtype:	Emnetegning
Location of file:	

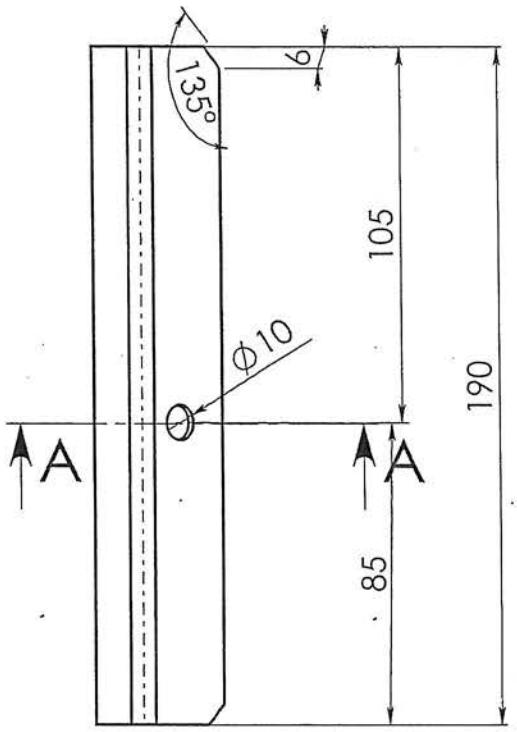
Title:
Isoleringsmåtte
2B Classic
Morsø 2B

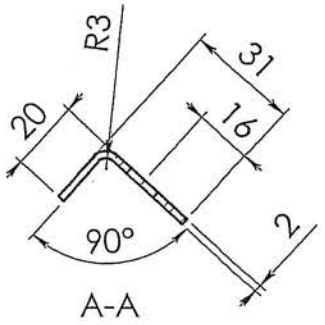
morsø

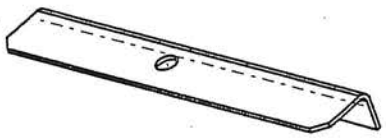
Drawing no.:
2B-90 b

Date of print: 30-06-2006

1 - 36 OF 1 - 50

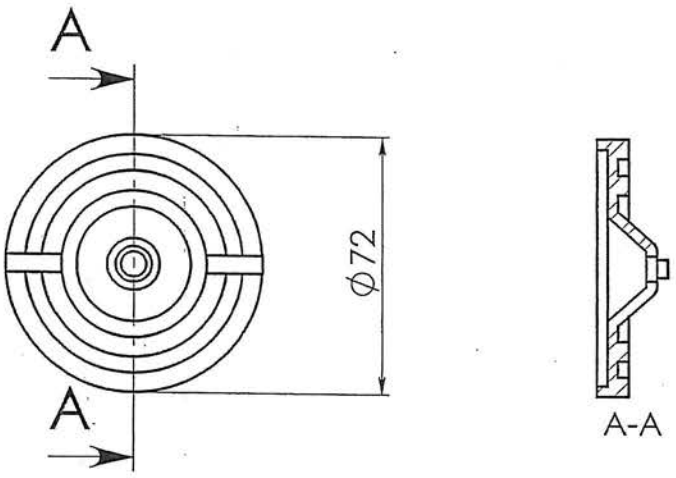


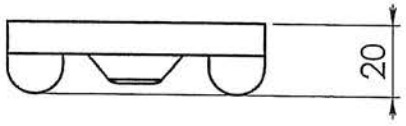




b	Diverse ændringer.		RSV	31.01.2006
Rev.	Revisions		Sign.:	Date:
	Title:	Construction:	RSV	04.11.05
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	**Varmeskjold front**	Released:	RSV	30.01.2006
Material: Rustfri stål	**2B Classic**	Format:	A4	
Weight: 0,13 kg		Scale:	1:2	
Model no.	**Morsø 2B**	Itemno.:	71209161	
Drawingtype: Emnetegning	morsø By appointment to the Royal Danish Court	Drawing no.:	2B-95 b	
Location of file: U:\udv\Tegninger\1B&2B\2B-95 Varmeskjold front 2B Classic.SLDPRT				

Date of print: 30-06-2006

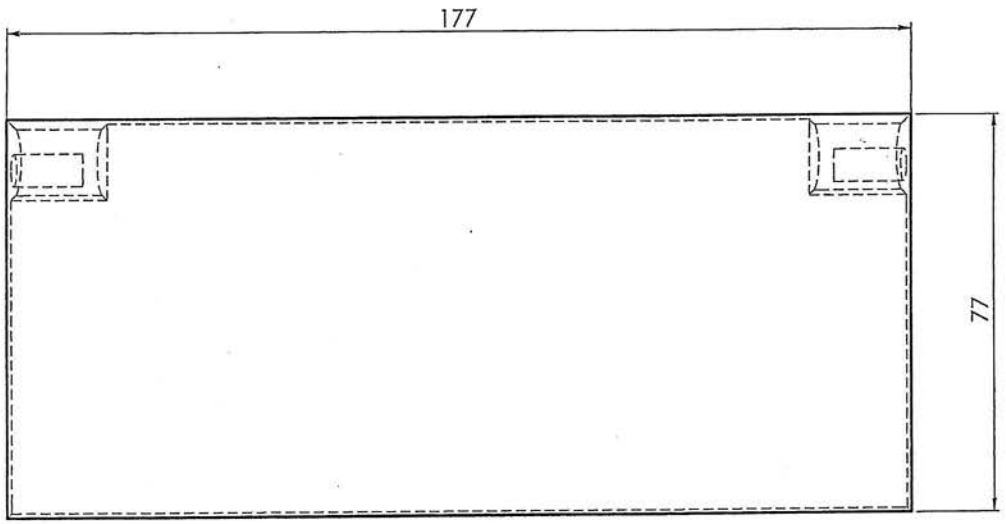


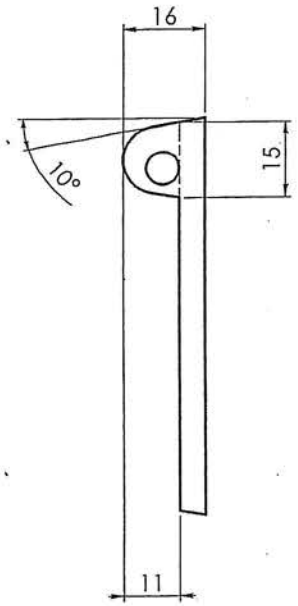


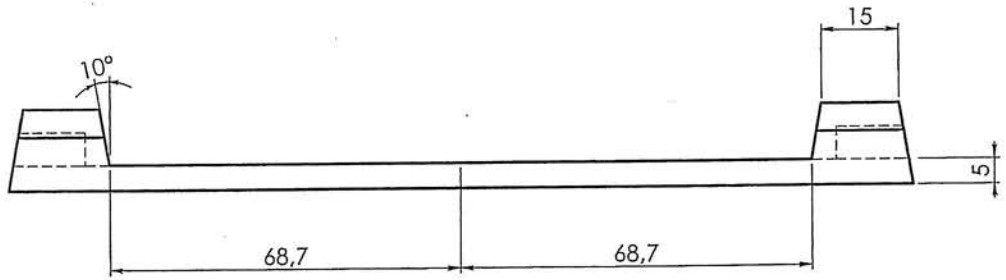
Konstruktionstegning
15.11.05

		Rev.	Revisions		Sign.:	Date:
		Title:		Construction:	RSV	15.11.05
Mål uden toleranceangivelse i.h.t. ISO-norm nr. 8062 CT9		**Trækventil**		Released:		
Material:	Cast iron GG15			Format:	A4	
Weight:	0,17 kg			Scale:	1:2	
Model no.	2022	**Morsø 2B**		Itemno.:	342022	
Drawingtype:	Emnetegning	morsø By appointment to HM the Royal Danish Court		Drawing no.:	2B-96	
Location of file:	U:\udv\Tegninger\1B&2B\2B-96 Trækventil 2B.SLDPRT					

Date of print: 30-06-2006







Konstruktionstegning
16.11.05

Rev.	Revisions	Sign.:	Date
		RSV	16.11.

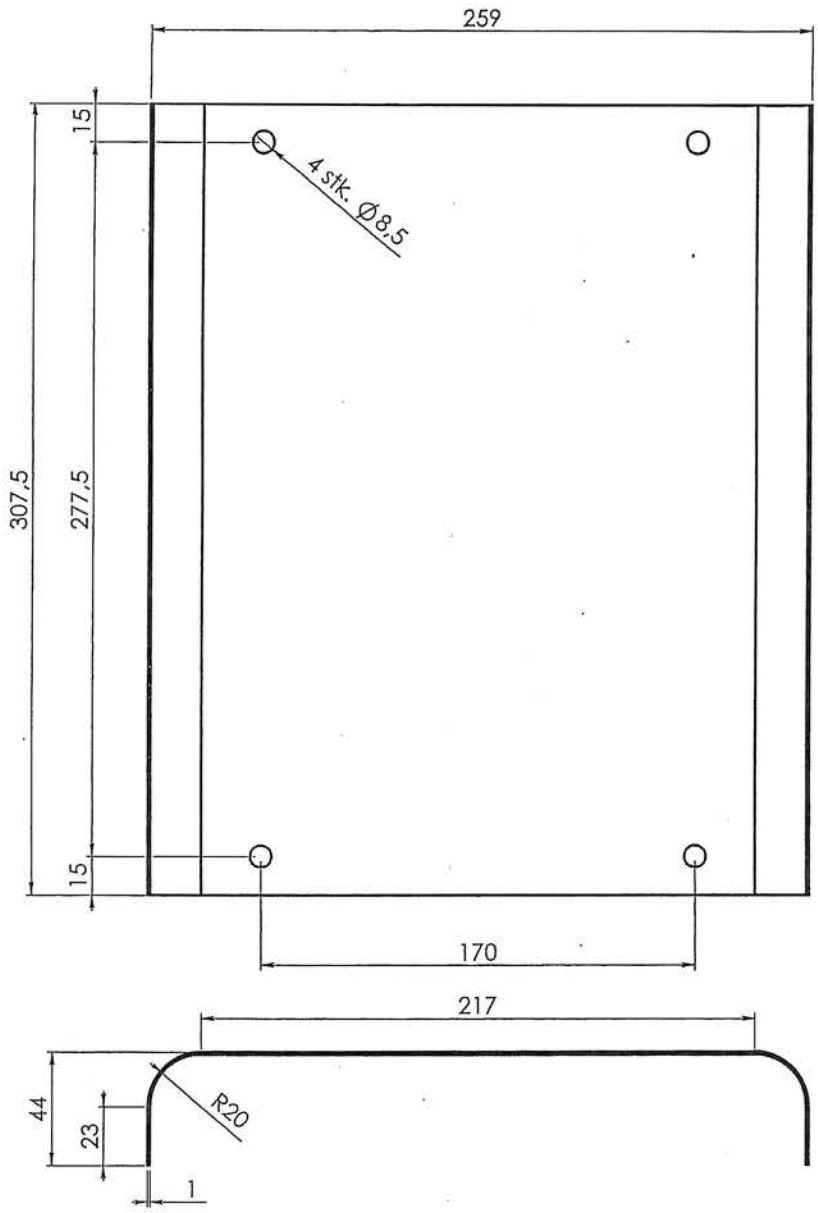
Mål uden toleranceangivelse i.h.t. ISO-norm nr. 8062 CT9	
Material:	Cast iron GG15
Weight:	0,51 kg
Model no.	2008
Drawingtype:	Støbetegning
Location of file:	

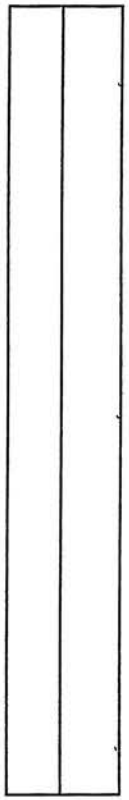
Title:
Klap til dør

Morsø 2B

morsø

Construction:	RSV 16.11.
Released:	
Format:	A3
Scale:	1:1
Item no.:	342008
Drawing no.:	2B-102





Rev.	Revisions	Sign.:	Dat

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

Material:	Galvaniseret plade
Weight:	0,79 kg
Model no.	
Drawingtype:	Emnetegning
Location of file:	

Title:
Stråleplade
bag
Morsø 2B

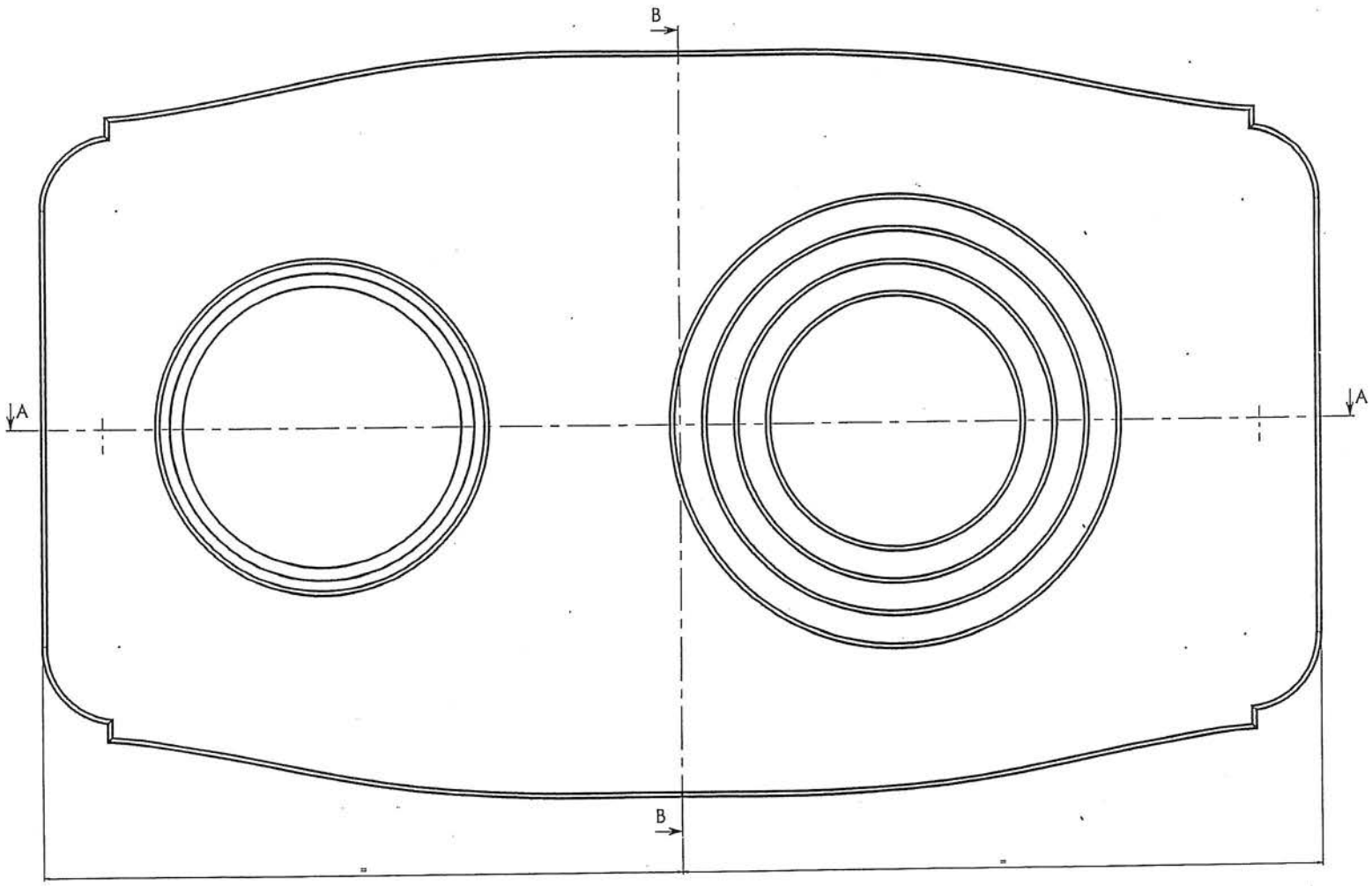
Construction:	RSV 22.03
Released:	RSV 21.04.:
Format:	A3
Scale:	1:2
Itemno.:	5420120

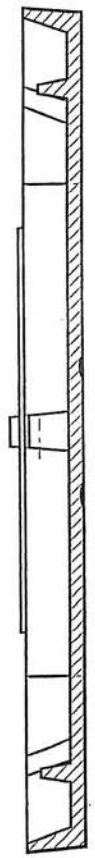
morsø

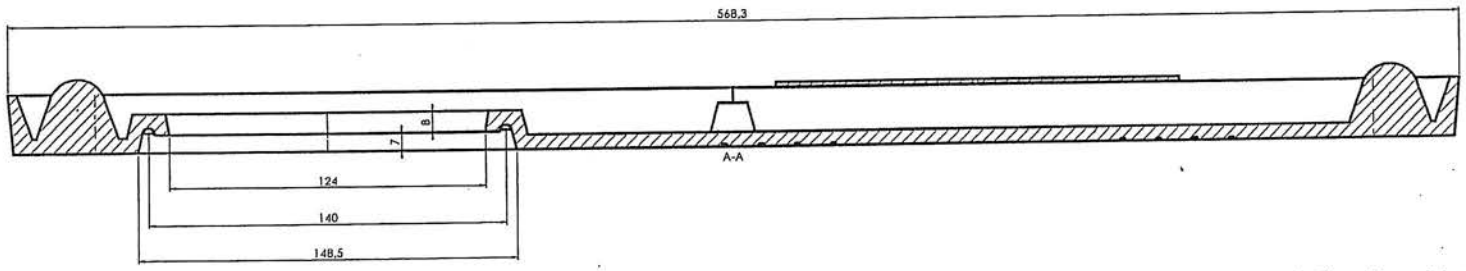
Drawing no.:
2B-108 a

Date of print: 30-06-2006

1 - 4 0 OF 1 - 5 0





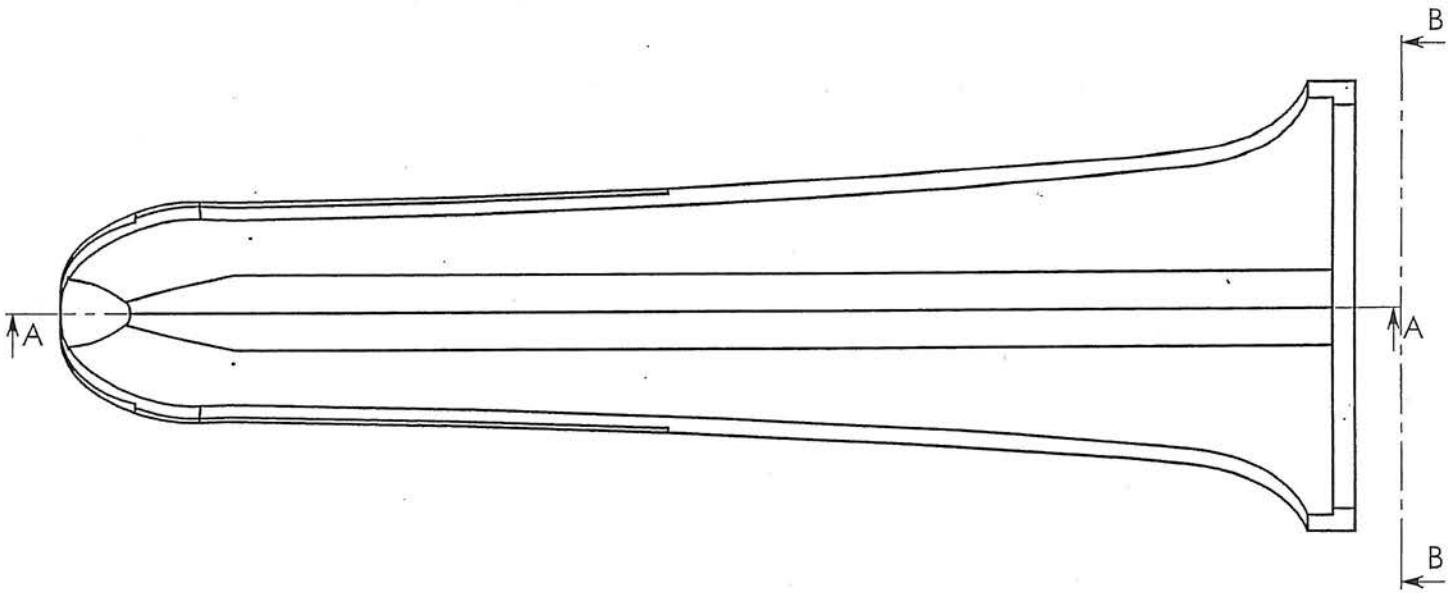


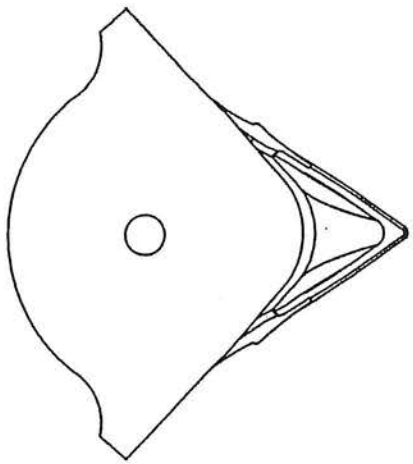
Konstruktionstegning
28.06.2006

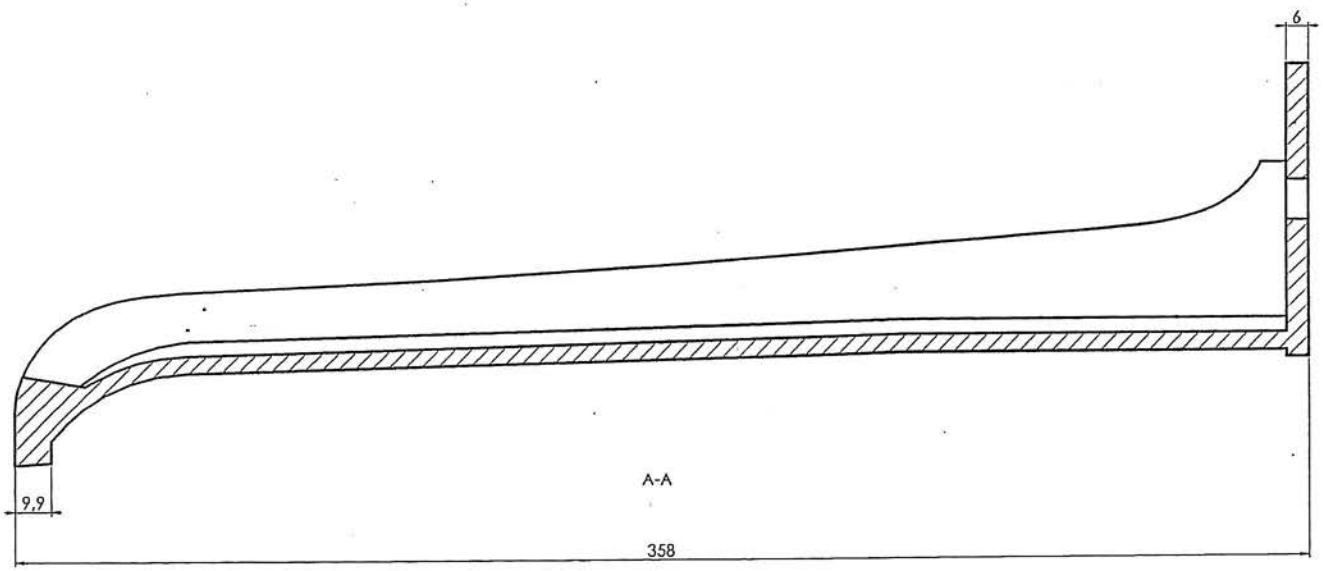
Revision af eksisterende modelnr. 2007
Øvrige mål, som eksisterende emne.

Titel:	Topplade
	Morsø 28 Standard
	morsø
	2B-

1-41 OF 1-50

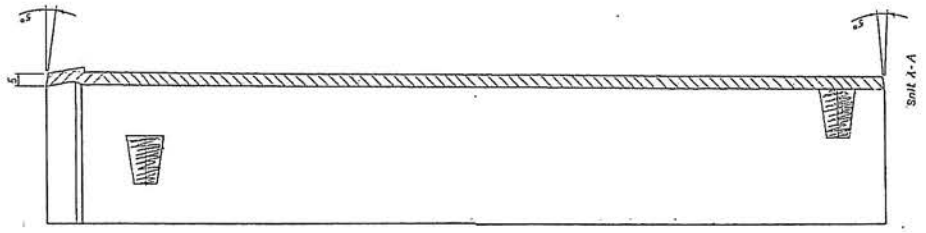


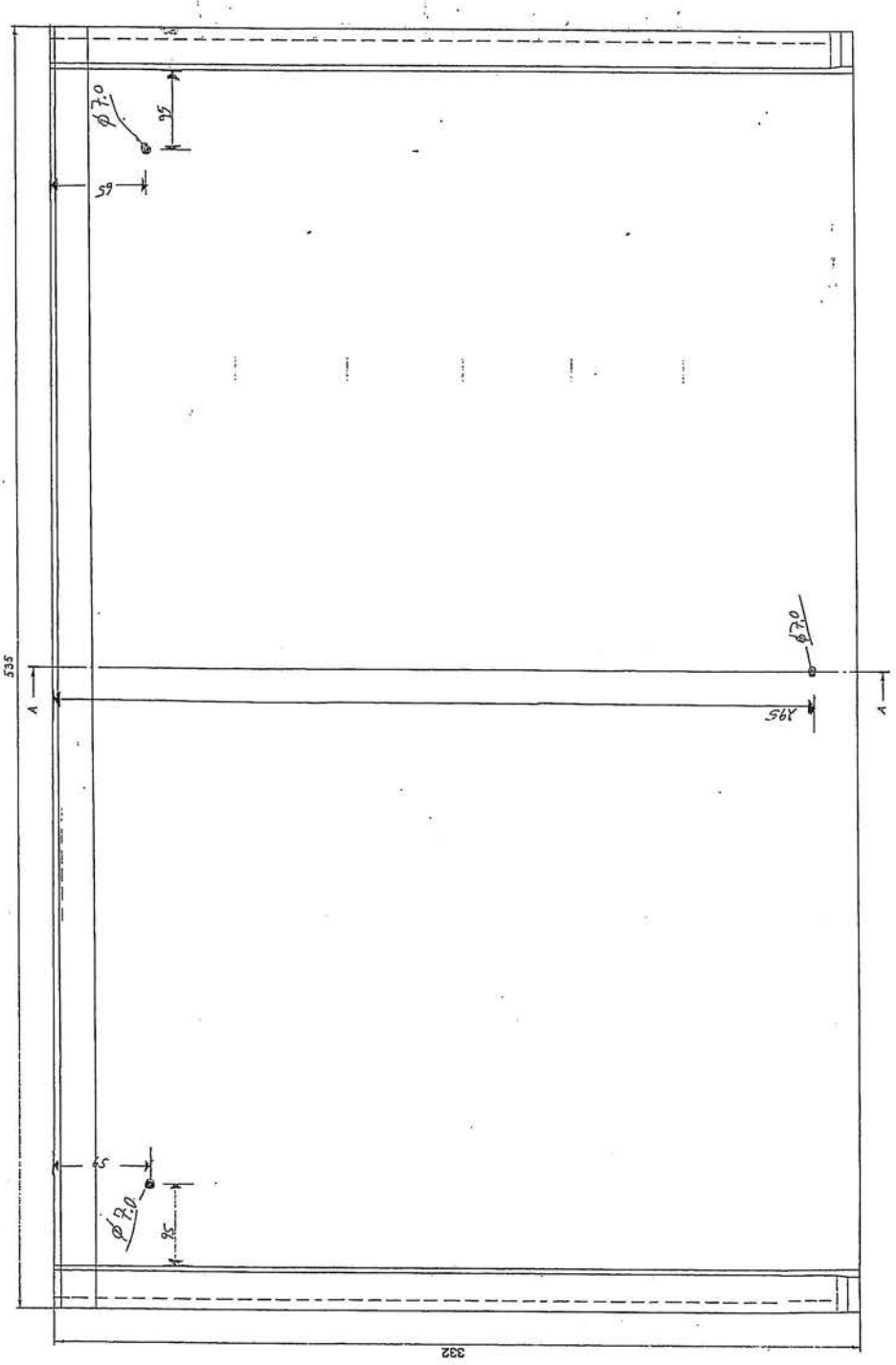


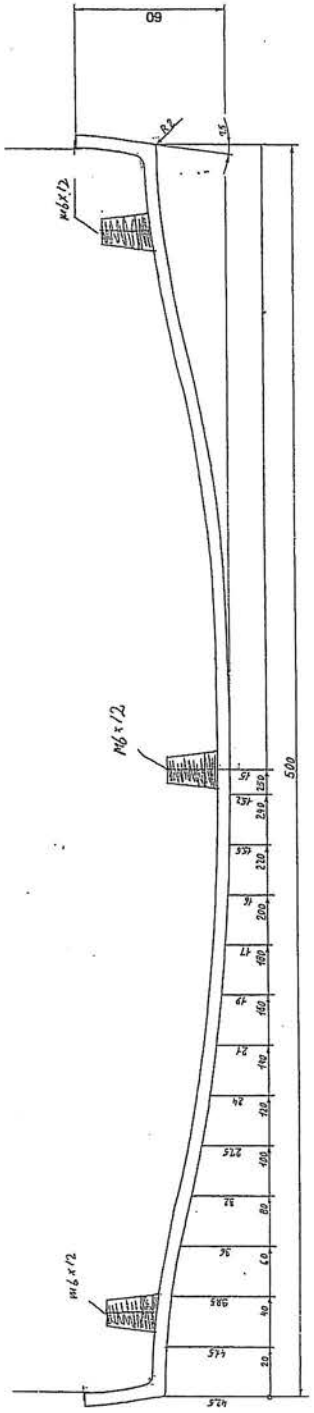


Konstruktionstegning
05.07.2006

Mål uden toleranceangivelse i h.t. DS/ISO 2768-1 m		Rev. Revision:	Sign.:
Material:	Støbejern GG 15	Title: Ben 2BU	Construction: RSV
Weight:	1,42 kg		Released:
Model no.	2001	Morsø 2B	Format: A
Drawingtype:	Emnetegning		Scale: 1
Location of file:	[illegible]	morsø	Item no.: 342
			Drawing no.: 2B-114



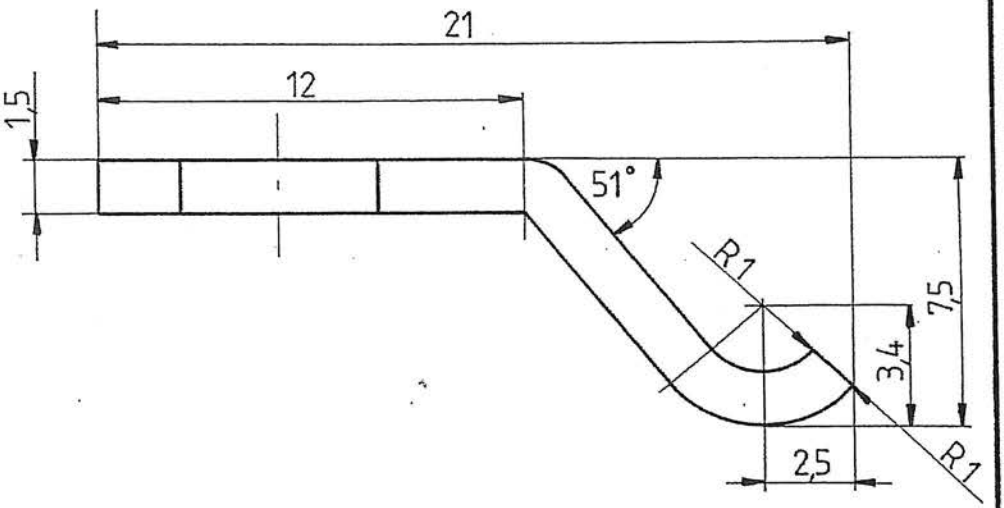


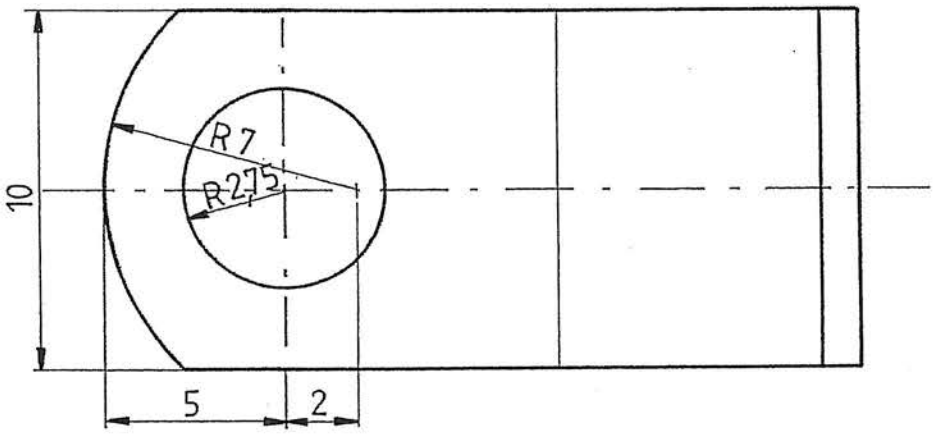


Konv. sideplade
2B Standard

1:1

2B-115 a

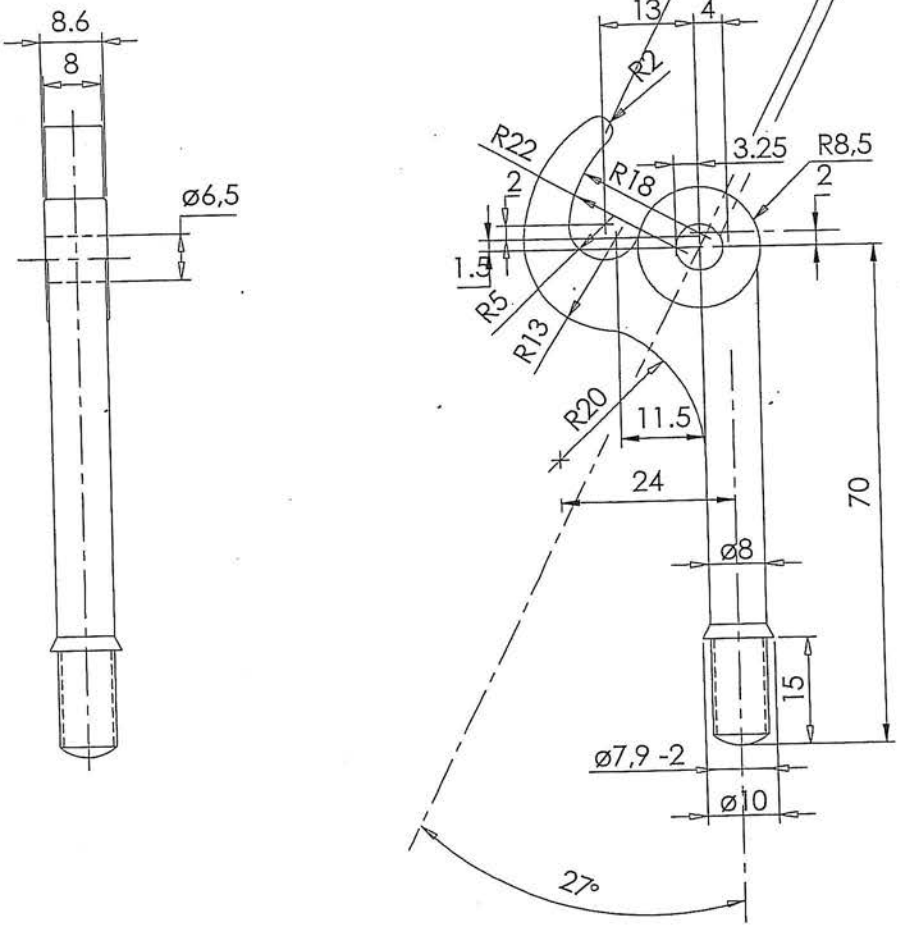




NB! Findes som solidworkspart
1124 / 1124-29 glasclips.prt.
24/7-00 / kou.

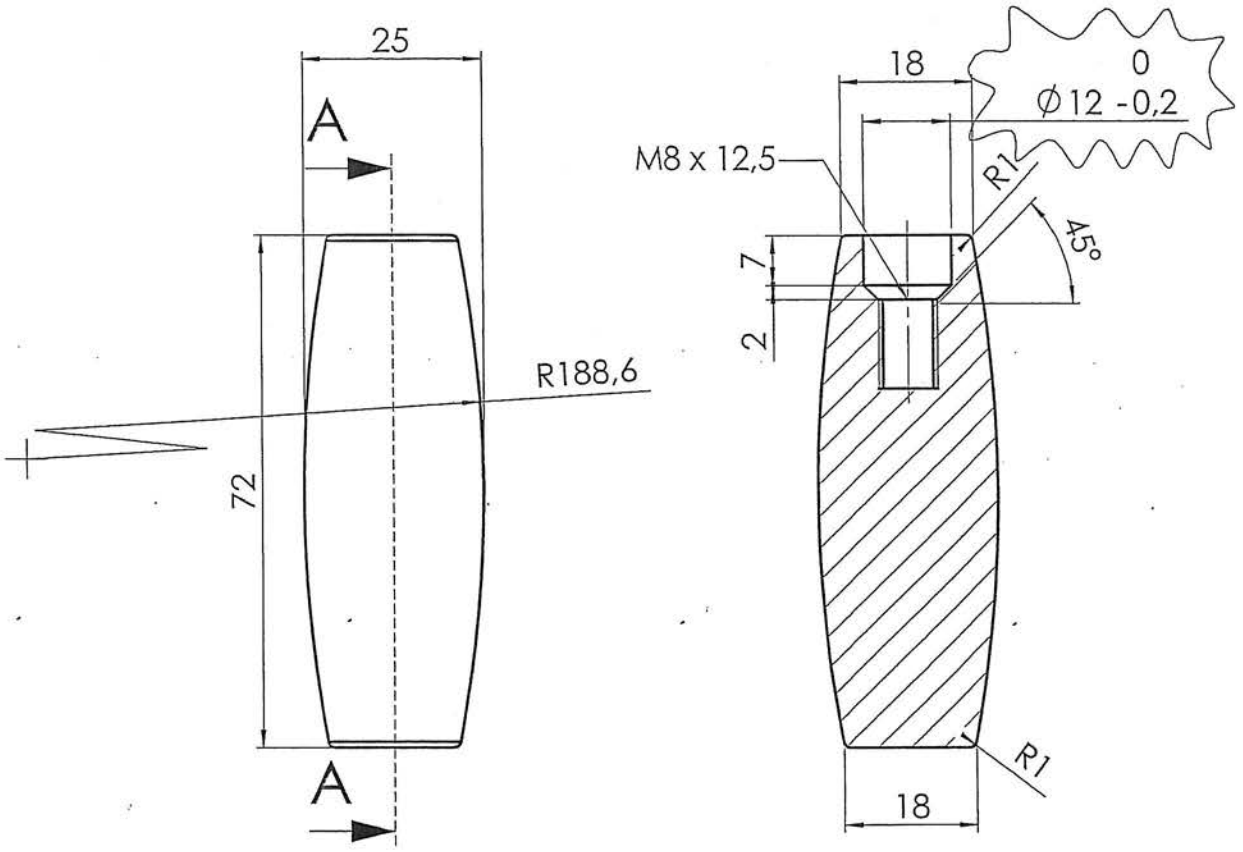
edbnr. 790743

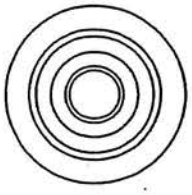
LEVERANDØR TIL DET KGL. DANSKE HOF morsø AKTIESELSKABET N. A. CHRISTENSEN & CO 7900 NYKØBING MORS TLF. 97 72 13 00	GLASKLIPS. 1,5mm rf.plade werkstoff nr. 14301	DATO 23-2-93	SIGN. AaGJ
		MÅL 5:1	ÆNDRET 5-12-84
			MODELNR.
		TEGNINGSNR. 1124-29-4	



Afrettet, afgratet, kuglerenset.
Matr.: DIN1680 Teil 2 GTA 1315

Titel: Lukkehage	Sign.: Aa.GJ	Dato: 04.02.93	Revision	Sign.	Dato
	Tegn.form.: A4	Målforhold 1:1	Gamdrup TegneTeknik	HCH	April 96
Tegningsnummer: 1400-42-4	Varenummer: 79127000				
morsø By appointment to the Royal Danish Court	Filnavn: 1400-42				

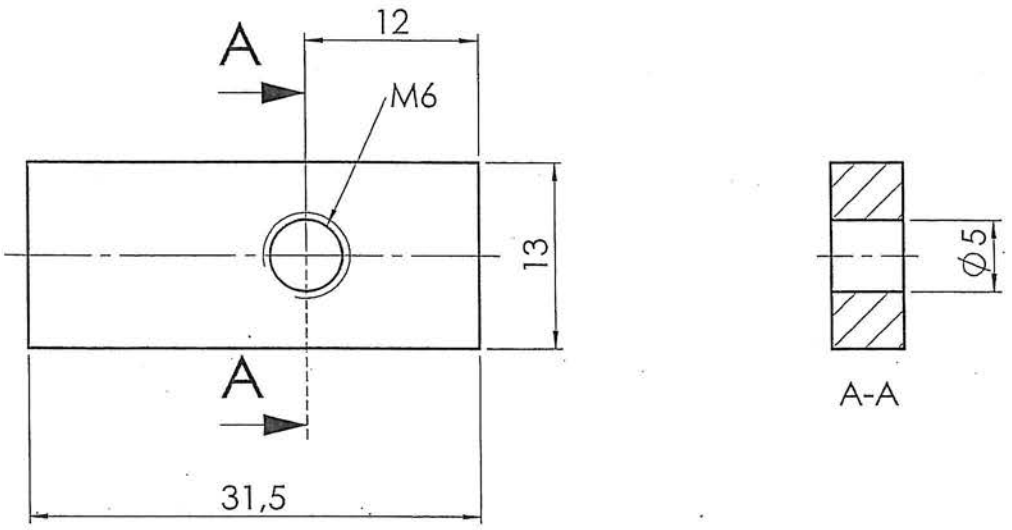


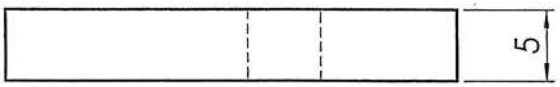


Rev.	Revisions	Sign.:	Date:
b	Påført tolerance ø12 hul	RSV	23.03.04

Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m	Title: Greb 1400 Barkelite handle Morsø 1400	Construction:	RSV	23.02.00
		Released:	RSV	02.08.00
Material: Vælg Materiale		Format:	A4	
Weight: 0,08 kg		Scale:	1:1	
Model no. -		Itemno.:	79118300	
Drawingtype: Emnetegning	morsø By appointment to the Royal Danish Court	Drawing no.:	1400-193 b	
Location of file: U:\udv\Tegninger\1400\1400-193 greb.SLDPRT				

Date of print: 30-06-2006

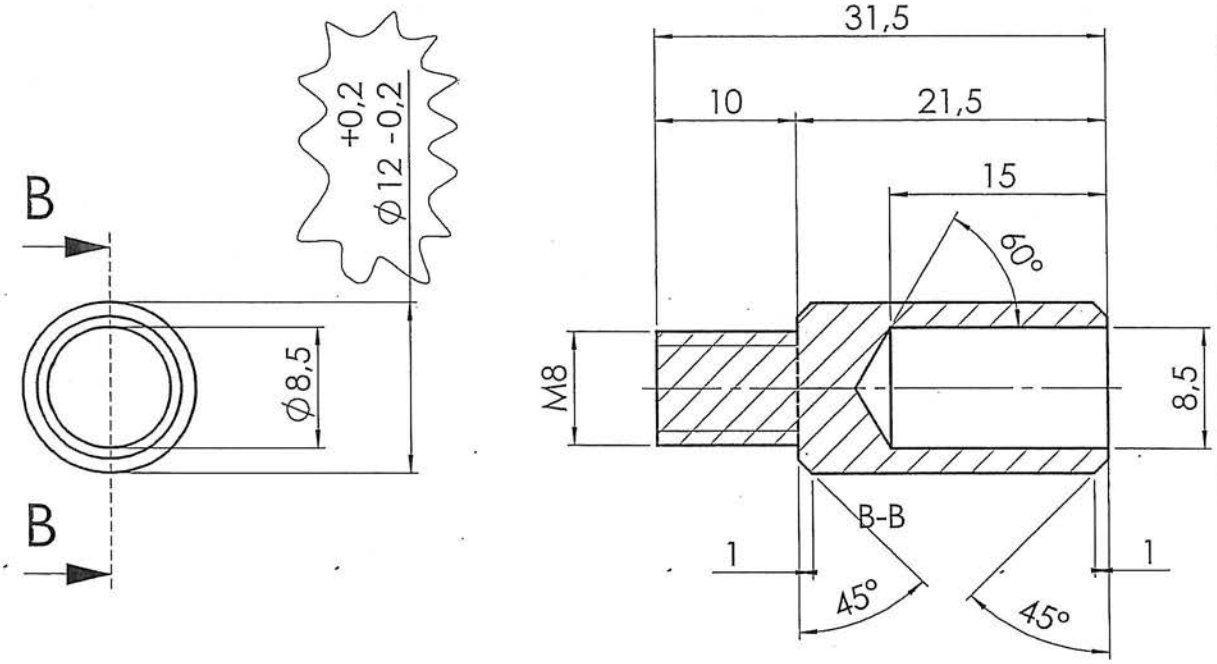




Rev.	Revisionstekst:	Sign.:	Dato:

Materiale:	Sort fladjern	Titel:	Konstr.:	RSV	03.03.2000
Vægt:	0,015 kg. Bearbejdes:	**Lus med gevind**	Frigivet:		
Overfladebeh.:	m²		Tegn.format:	A4	
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m		Målforhold:	2:1	
Ruhedstolerance:		**Morsø 1400**	Varenr.:	44256700	
Værktøjsnr.:		morsø By appointment to the Royal Danish Court	Tegningsnr.:		
Tegningstype:	Emnetegning			**1400-204**	

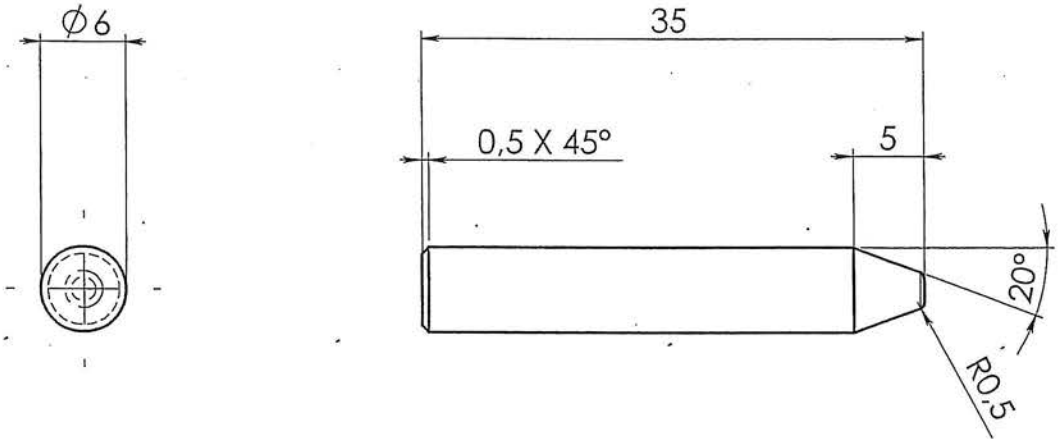
1400-204 lus med gevind - Sheet1



Rev.	Revisionstekst:	Sign.:	Dato:
b	Ændret yderdiameter + påført tolerance.	RSV	23.03.04

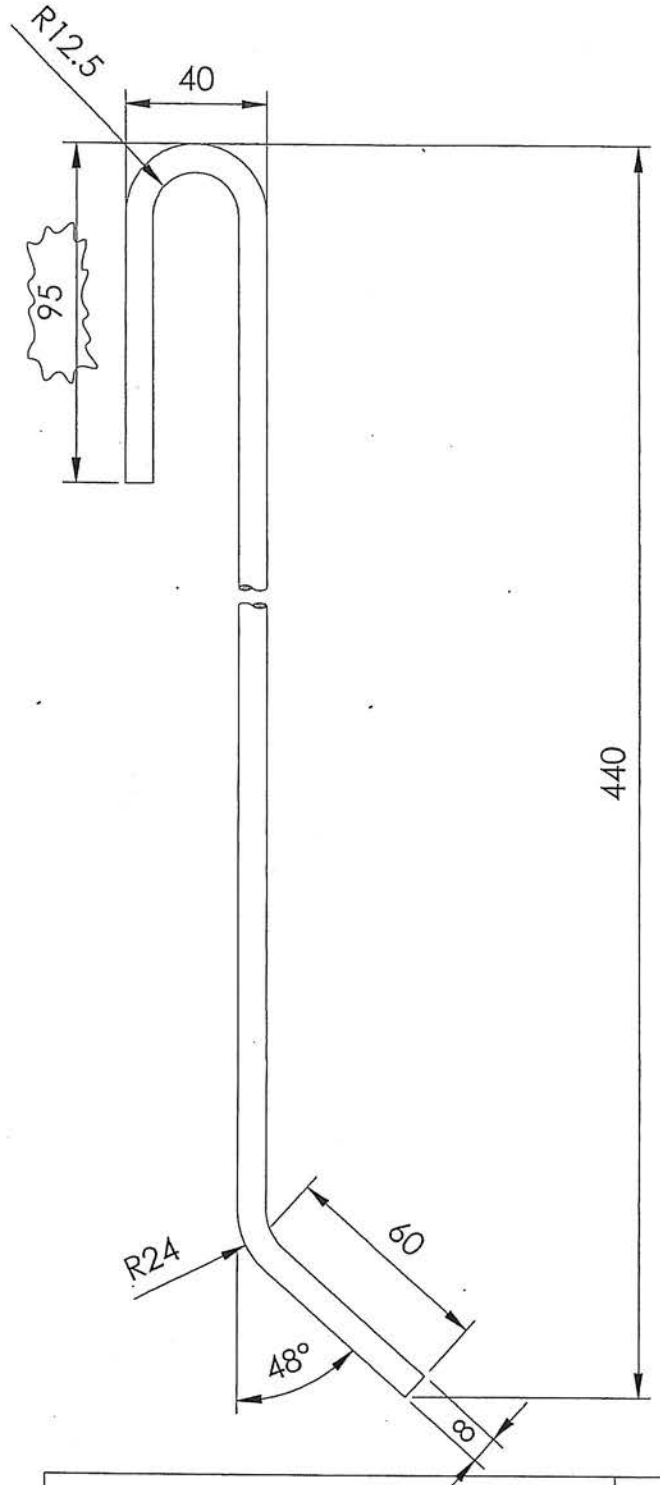
Materiale:	Rustfri stål			Titel:	Konstr.:	RSV 30.04.2002
Vægt:	14.5 g	Bearbejdes:		**Overgangsstykke til greb Morsø 1400**	Frigivet:	
Overfladebeh.:			m²		Tegn.format:	A4
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m				Målforhold:	2:1
Ruhedstolerance:					Varenr.:	75140161
Værktøjsnr.:				morsø By appointment to HM the Royal Danish Court	Tegningsnr.:	1400-227 b
Tegningstype:	Emnetegning					

1400-227 overgangsstykke til greb m gevind - Sheet1



		Rev.	Revisions		Sign.:	Date:
		Title:		Construction:	RSV	26.01.04
Mål uden toleranceangivelse i.h.t. DS/ISO 2768-1 m		**ø6x45 Hængselsstift**		Released:		
Material:	Rustfri stål			Format:	A4	
Weight:	0,05 kg			Scale:	**2:1**	
Model no.	-	**Morsø 2100**		Itemno.:	**541808**	
Drawingtype:	Emnetegning	morsø By appointment to the Royal Danish Court		Drawing no.:	**2100-174 a**	
Location of file:	U:\udv\Tegninger\standardbibliotek\ø6 Hængselstift.SLDPRT					

Date of print: 30-06-2006



Matr.: ø8 mm automatstål | Vægt: 0,2 Kg.

Rev.	Revision	Sign.	Dato
b	Ombuk forlænget 70 mm	KDU	11.06.99

Titel:
Ildrager
New Generation/Classic

Sign.:	Dato:
KAA	30.07.98
Tegn.form.:	Målforhold
A4	1:2

Filnavn: 9000-05

Varenummer: 79900321

morsø
Jernstøberi A/S

Tegningsnummer: 9000-05 b

Section 2

Quality Assurance/Quality Control

QUALITY ASSURANCE/QUALITY CONTROL

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

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

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

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

Sample Analysis

Analysis Worksheets
Tared Filter and Beaker Data
Solvent Blank Data

OMNI-Test Laboratories,
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: Morso
Model: 2B
Project #: 192-S-09-3 Tracking #: 879
Date: 7-18-06 Test Crew: K. Morgan Run #: 1
Sample Train #: _____ Train assembled by: K. Morgan
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI -
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter Lab ID # _____ ID # N150 Tare wt. .5613 D/T in desiccator 7-18-06 12:50 Preliminary wt.: .5698	7-19-06	~~15:30~~ 17:30	.5696	.5001	17	75	JL
	7-20-06	07:30	.5696	.5001	17	79	JL
Rear Filter Lab ID # _____ ID # N149 Tare wt. .5867 D/T in desiccator: 7-18-06 12:50 Preliminary wt.: .5869	7-19-06	17:30	.5866	.5001	17	75	JL
	7-20-06	07:30	.5867	.5001	17	79	JL
Acetone Rinse Lab ID # _____ Beaker # 910 Tare wt. 106.5674 Volume 75 ml Cleaned by: JL Solvent #: SA078 D/T in desiccator: 7-19-06 07:40 Preliminary wt.: 106.5738	7-20-06	07:30	106.5721	.5001	17	79	JL
	7-20-06	17:00	106.5723	.5001	17	80	JL

Technician signature: K. A. Morgan Date: 7-20-06

OMNI-Test Laboratories,
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: Morso
Model: 2B
Project #: 192-S-09-3 Tracking #: 879
Date: 7-18-06 Test Crew: K. Morgan Run #: 2
Sample Train #: _____ Train assembled by: K. Morgan
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI -
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter	7-19-06	~~15:30~~ 17:30	.5446	.5001	17	75	K
Lab ID # _____	7-20-06	07:30	.5445	.5001	17	79	IK
ID # N152							
Tare wt. .5267							
D/T in desiccator 7-18-06 15:30							
Preliminary wt.: .5444							
Rear Filter	7-19-06	~~15~~ 17:30	.5659	.5001	17	75	IK
Lab ID # _____	7-20-06	07:30	.5658	.5001	17	79	IK
ID # N151							
Tare wt. .5673							
D/T in desiccator: 7-18-06 15:30							
Preliminary wt.: .5660							
Acetone Rinse	7-20-06	07:30	104.8326	.5001	17	79	IK
Lab ID # _____	7-20-06	17:00	104.8327	.5001	17	80	IK
Beaker # 2040							
Tare wt. 104.8268							
Volume 100 ml							
Cleaned by: IK							
Solvent #: SA076							
D/T in desiccator: IK ~~7-18-06~~ 7-19-06 07:30							
Preliminary wt.: 104.8344							

Technician signature: IK J. Morgan Date: 7-20-06

OMNI-Test Laboratories,
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: Morso
Model: 2B
Project #: 192-S-09-3 Tracking #: 879
Date: 7-19-06 Test Crew: K. Morgan Run #: 3
Sample Train #: Train assembled by: K. Morgan
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI -
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter Lab ID # ID # N154 Tare wt. .5726 D/T in desiccator 7-19-06 13:00 Preliminary wt.: .5781	7-20-06	17:00	.5778	.5001	17	80	IK
	7-21-06	06:40	.5778	.5001	17	71	IK
Rear Filter Lab ID # ID # N153 Tare wt. .5839 D/T in desiccator: 7-19-06 13:00 Preliminary wt.: .5832	7-20-06	17:00	.5832	.5001	17	80	IK
	7-21-06	06:40	.5831	.5001	17	71	IK
Acetone Rinse Lab ID # Beaker # 942 Tare wt. 103.4238 Volume 75 ml Cleaned by: IK Solvent #: SA078 D/T in desiccator: 7-20-06 07:30 Preliminary wt.: 103.4290	7-21-06	06:40	103.4292	.5001	17	71	IK
	7-21-06	14:10	103.4292	.5001	17	74	IK

Technician signature: IK J. Morgan Date: 7-21-06

OMNI-Test Laboratories,
Beaverton, OR

Dilution Tunnel (Method 5G) Analysis Worksheet

Client: Morso
Model: 2B
Project #: 192-S-09-3 Tracking #: 879
Date: 7-19-06 Test Crew: K. MORGAN Run #: 4
Sample Train #: _____ Train assembled by: K. MORGAN
Balance ID #: OMNI - 00023 Thermo/Hygro meter ID #: OMNI -
Audit weight ID #: OMNI – 00131 (Balance audit mfr. std: 500 ± 0.72 mg)

Train Part	Weighing Record						
	Date	Time	Weight (grams)	Audit (grams)	R/H %	Temp. (F)	Initials
Front Filter	7-20-06	17:00	.5527	.5001	17	80	JK
Lab ID # _____	7-21-06	06:40	.5527	.5001	17	71	JK
ID # N158							
Tare wt. .5443							
D/T in desiccator 7-19-06 17:10							
Preliminary wt.: .5529							
Rear Filter	7-20-06	17:00	.5734	.5001	17	80	JK
Lab ID # _____	7-21-06	06:40	.5735	.5001	17	71	JK
ID # N157							
Tare wt. .5742							
D/T in desiccator: 7-19-06 17:10							
Preliminary wt.: .5736							
Acetone Rinse	7-21-06	06H0	103.0462	.5001	17	71	JK
Lab ID # _____	7-21-06	14:10	103.0461	.5001	17	74	JK
Beaker # 2189							
Tare wt. 103.0411							
Volume 75 ml							
Cleaned by: JK							
Solvent #: SA078							
D/T in desiccator: ~~7-19-06 17:10~~ 7-20-06 17:30 JK							
Preliminary wt.: 103.0459							

Technician signature: K. J. Morgan Date: 7-21-06

AE Glass 102 mm Filter Tares

OMNI-Test Laboratories, Inc

Date Placed in Desiccator	15-Jun-06			Balance ID Number	OMNI-00023						
Time Placed in Desiccator	7:30 AM			Audit Weight ID Number	OMNI-00131						
Technician	Morgan			Thermometer/Hygrometer ID Number	OMNI-00291						
	Date:	6/16/2006	6/19/2006								
	Time:	4:00 PM	10:50 AM								
	RH %:	13	12	0	0						
102 mm Filters	T (F):	76	71	0	0						
	Tech.:	Morgan	Morgan								
ID Number	Audit:	0.5001	0.5001	0	0	Manufacturer	Appliance	Project No.	Run	Train	
N149		0.5869	0.5867	X	0	0	Morso	2B	192-S-09-3	1	
N150		0.5615	0.5613	X	0	0	Morso	2B	192-S-09-3	1	
N151		0.5673	0.5673	X	0	0	Morso	2B	192-S-09-3	2	

K. T. Morgan
7-26-06

AE Glass 102 mm Filter Tares

OMNI-Test Laboratories, Inc

Date Placed in Desiccator	17-Jul-06			Balance ID Number	OMNI-00023						
Time Placed in Desiccator	7:00 AM			Audit Weight ID Number	OMNI-00131						
Technician	Morgan			Thermometer/Hygrometer ID Number							
	Date:	7/18/2006	7/18/2006								
	Time:	7:15 AM	1:40 PM								
	RH %:	17	17	0	0						
	T (F):	73	73	0	0						
102 mm Filters	Tech.:	Morgan	Morgan								
ID Number	Audit:	0.5001	0.5001	0	0	Manufacturer	Appliance	Project No.	Run	Train	
N152		0.5266	0.5267	X	0	0	Morso	2B	192-S-09-3	2	
N153		0.5837	0.5839	X	0	0	Morso	2B	192-S-09-3	3	
N154		0.5726	0.5726	X	0	0	Morso	2B	192-S-09-3	3	
N157		0.5741	0.5742	X	0	0	Morso	2B	192-S-09-3	4	
N158		0.5444	0.5443	X	0	0	Morso	2B	192-S-09-3	4	

K. J. Morgan
7-26-06

Date Placed in Desiccator	07-Jun-06	Balance ID Number	OMNI-00023
Time Placed in Desiccator	8:25 AM	Audit Weight ID Number	OMNI-00131
Technician	Davis	Thermometer/Hygrometer ID Number	OMNI-00291

250 ml Beaker Tares

OMNI-Test Laboratories, Inc

250 ml Beakers ID Number											
	Date:	6/8/2006	6/9/2006	6/15/2006	6/20/2006						
	Time:	9:50 AM	9:00 AM	4:05 PM	9:40 AM						
	RH %:	12	11	13	13						
	T (F):	73	74	74	75						
	Tech.:	Davis	Morgan	Morgan	Davis						
	Audit:	0.5001	0.5001	0.5001	0.5001						
910		106.5684	106.5678	106.5674	X	0	Morso	2B	192-S-09-3	1	

7-26-06

Date Placed in Desiccator	20-Jun-06	Balance ID Number	OMNI-00023
Time Placed in Desiccator	10:30 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:	6/21/2006	6/27/2006		7/18/2006		7/19/2006						
Time:	11:25 AM	8:10 AM		7:15 AM		7:25 AM						
RH %:	13	11		17		18						
T (F):	75	76		73		72						
Tech.:	Davis	Davis		Morgan		Morgan						
Audit:	0.5001	0.5001		0.5001		0.5001		Manufacturer	Appliance	Project No.	Run	Train
2189	103.0454	103.0437		103.0411		103.0411	X	Morso	2B	192-S-09-3	4	
2040	104.8273	104.8267		104.8268	X	0		Morso	2B	192-S-09-3	2	
942	103.4262	103.4275		103.424		103.4238	X	Morso	2B	192-S-09-3	3	

H. J. Morgan
7-26-06

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

Acetone Solvent Blank Analysis Worksheet

Date: 3-1-06 By: B. Davis Balance ID #: OMNI – 00023

Manuf. Lot #: C180103SP Solvent Bottle #: SA078 Audit Weight ID #: OMNI – 00131
(Balance audit mfr. std.: 500 ± 0.72 mg)

Mls. Sample	ID No.	Tare Weight	Date & Time in Dessicator	Weighing Record				Initials	Calculations & Remarks
				Date	Time	Weight	Audit Weight		
150	2195	104.4236	3-03-06 & 09:00 104.4266	3-4-06 3-7-06	0920 0807	~~102.8377~~ 104.4239 104.4243	.5001 .5001	BR DK	0.7/150 .0047
150	2000	102.8382	3-3-06 & 09:00 102.8402	3-4-06 3-7-06	0920 0807	102.8377 102.8378	.5001 .5001	BR BR	-0.4/150 -.0027 Ø
			&						.0047/2 = .0024 mg/mL

Technician Signature: [signature] Date: 6-30-06

Checked by: [signature] Date: 6/30/06 Approved by: [signature] Date: 6/30/06

2 - 12 OF 2 - 52

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/Incline Manometer	Control Module – Sierra Misco	Calibration Log
23	Scale-Analytical Balance	Analytical Balance – Mettler	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
156	Incline Manometer	Incline Manometer, 0-10" – Dwyer	Calibration Log
183	Moisture Meter	Moisture Meter – Delmhorst	Manual
185	Platform Scale	Platform Scale – Weigh-Tronix	Calibration Log
209	Barometer	Barometer – Princo	Manual Cover
265	Vaneometer	Vaneometer, Air Velocity Meter – Dwyer	Calibration Log
272	500 mg Weight	Weight Standard, 500 mg – Ohaus	Calibration Log
274	10 lb Weight	Weight Standard, 10 lb	Calibration Log
291	Relative Humidity Gauge	Digital Hygrometer/Thermometer – Omega	Calibration Log
300	Stopwatch	Digital Stopwatch – Sportline	Calibration Log

Standard Gas Test Meter Calibration vs. Bubble Flowmeter

Date: 4/26/06

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: 30.04 "Hg

Average Y Factor: 0.9828

Signature/Date: K. Morgan 4-26-06

Flow Rate #1 dH(pressure across meter, "H2O): 0.35			
	Run #1	Run #2	Run #3
Standard Test Meter			
Initial Volume (ft3):	20.35	23.306	23.964
Final Volume (ft3):	21.223	23.964	24.645
Initial Temperature (oF):	64	66	66
Final Temperature (oF):	64	67	67
Elapsed Time (minutes):	4	3	3
(seconds):	0	0	10
Flow rate, Q (cfm):	0.2182	0.2193	0.2151
Bubble Flowmeter			
Time 1:	9.9	9.78	9.78
Time 2:	9.9	9.75	9.78
Time 3:	9.84	9.81	9.9
Time 4:	9.87	9.75	9.71
Time 5:	9.9	9.81	9.9
Initial Temperature (oF):	64	66	66
Final Temperature (oF):	64	67	67
Vacuum ("H20):	1	1	1
Flow rate, Q (cfm):	0.2145	0.2168	0.2160
Y factor:	**0.9822**	**0.9875**	**1.0037**

Deviation of Y factor is acceptable

Flow Rate #2 dH(pressure across meter, "H2O): 0.4			
	Run #1	Run #2	Run #3
Standard Test Meter			
Initial Volume (ft3):	26.071	26.071	26.753
Final Volume (ft3):	26.753	26.753	27.686
Initial Temperature (oF):	67	67	68
Final Temperature (oF):	67	67	68
Elapsed Time (minutes):	3	3	4
(seconds):	0	0	0
Flow rate, Q (cfm):	0.2273	0.2273	0.2333
Bubble Flowmeter			
Time 1:	9.35	9.34	9.35
Time 2:	9.31	9.34	9.34
Time 3:	9.3	9.31	9.4
Time 4:	9.31	9.25	9.21
Time 5:	9.35	9.35	9.28
Initial Temperature (oF):	67	67	67
Final Temperature (oF):	67	67	67
Vacuum ("H20):	1	1	1
Flow rate, Q (cfm):	0.2274	0.2275	0.2276
Y factor:	**0.9994**	**1.0000**	**0.9767**

Deviation of Y factor is acceptable

Flow Rate #3 dH(pressure across meter, "H2O): 0.55			
	Run #1	Run #2	Run #3
Standard Test Meter			
Initial Volume (ft3):	28.7	29.837	30.967
Final Volume (ft3):	29.837	30.967	32.095
Initial Temperature (oF):	67	68	68
Final Temperature (oF):	68	68	68
Elapsed Time (minutes):	4	4	4
(seconds):	0	0	0
Flow rate, Q (cfm):	0.2843	0.2825	0.2820
Bubble Flowmeter			
Time 1:	7.71	7.78	7.59
Time 2:	7.68	7.62	7.68
Time 3:	7.65	7.65	7.65
Time 4:	7.65	7.62	7.68
Time 5:	7.71	7.68	7.59
Initial Temperature (oF):	67	68	68
Final Temperature (oF):	68	68	68
Vacuum ("H20):	1	1	1
Flow rate, Q (cfm):	0.2761	0.2764	0.2776
Y factor:	**0.9704**	**0.9776**	**0.9835**

Deviation of Y factor is acceptable

Flow Rate #4 dH(pressure across meter, "H2O): 0.75			
	Run #1	Run #2	Run #3
Standard Test Meter			
Initial Volume (ft3):	32.502	33.512	35.521
Final Volume (ft3):	33.512	35.521	36.529
Initial Temperature (oF):	68	67	68
Final Temperature (oF):	68	67	68
Elapsed Time (minutes):	3	6	3
(seconds):	0	0	0
Flow rate, Q (cfm):	0.3367	0.3348	0.3360
Bubble Flowmeter			
Time 1:	6.46	6.46	6.5
Time 2:	6.4	6.5	6.5
Time 3:	6.46	6.59	6.55
Time 4:	6.44	6.5	6.43
Time 5:	6.46	6.5	6.53
Initial Temperature (oF):	68	67	67
Final Temperature (oF):	68	67	67
Vacuum ("H20):	1	1	1
Flow rate, Q (cfm):	0.3290	0.3257	0.3261
Y factor:	**0.9764**	**0.9718**	**0.9715**

Deviation of Y factor is acceptable

Standard Gas Test Meter Calibration vs. Bubble Flowmeter

Date: 4/26/06

Calibrated by: K. Morgan

Standard Test Meter S/N: OMNI 00001

Bubble Flow Meter S/N: OMNI 00134

Barometric Pressure: 30.04 "Hg

Average Y Factor: 0.9828

(Volume: 1.000 liters = 0.035336 ft3, NIST traceable)

Signature/Date: K. Morgan 4-26-06

Flow Rate #5 dH(pressure across meter, "H2O): 1			
	Run #1	Run #2	Run #3
Standard Test Meter			
Initial Volume (ft3):	37.003	38.262	39.95
Final Volume (ft3):	38.262	39.95	41.207
Initial Temperature (oF):	67	66	67
Final Temperature (oF):	67	66	67
Elapsed Time (minutes):	3	4	3
(seconds):	0	0	0
Flow rate, Q (cfm):	0.4197	0.4220	0.4190
Bubble Flowmeter			
Time 1:	5.24	5.08	5.08
Time 2:	5.18	5.14	5.08
Time 3:	5.06	5.3	5.2
Time 4:	5.18	5.12	5.1
Time 5:	5.12	5.14	5.12
Initial Temperature (oF):	67	66	67
Final Temperature (oF):	66	66	67
Vacuum ("H20):	1	1	1
Flow rate, Q (cfm):	0.4112	0.4112	0.4144
Y factor:	**0.9799**	**0.9736**	**0.9882**
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.

Thermal Metering System Calibration
Y and dH@

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

Average Orifice Meter dH@	Average Gas Meter y Factor
1.626	0.993

Calibration Date:	07/20/06
Calibrated by:	Ken Morgan
Calibration Frequency:	Post-Test Series
Next Calibration Due:	01/18/07
Instrument Range:	1.000 cfm
Standard Temp.:	68 oF
Standard Press.:	29.92 "Hg
Barometric Press.:	30.04 "Hg
Signature/Date:	K. J. Morgan 7-20-06

Previous Calibration Comparision

Date	5/17/06	Acceptable	
dH@ Value	1.526	Deviation (5%)	Deviation
y Factor	0.991	0.04955	0.002
Acceptance	Acceptable		

Current Calibration

Acceptable y Deviation	0.020
Maximum y Deviation	0.000
Acceptable dH@ Deviation	0.200
Maximum dH@ Deviation	0.001
Acceptance	Acceptable

Reference Standard *			
Standard Calibrator	Model	Standard Test Meter	
	S/N	1	
	Calib. Date	26-Apr-06	
	Calib. Value	0.9828	y factor (ref)

Calibration Parameters	Run 1	Run 2	Run 3
Vacuum ("Hg)	1.00	1.00	1.00
dH ("H2O)	0.75	0.75	0.75
Initial Reference Meter	128.472	133.482	139.493
Final Reference Meter	133.482	139.493	145.252
Initial DGM	303.852	309.106	315.415
Final DGM	309.106	315.415	321.462
Temp. Ref. Meter (°F), Tr	68.0	69.0	69.0
Temperature DGM (°F), Td	100.0	102.0	102.0
Time (Minutes)	10.0	12.0	11.5
Net Volume Ref. Meter, Vr	5.010	6.011	5.759
Net Volume DGM, Vd	5.254	6.309	6.047
Gas Meter y Factor =	**0.992**	**0.993**	**0.993**
Gas Meter y Factor Deviation (from avg.)	0.000	0.000	0.000
Orifice dH@	**1.63**	**1.63**	**1.63**
Orifice dH@ Deviation (from avg.)	0.001	0.000	0.001

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

Certificate of Calibration

Certificate # 335439 Page # 1 of 1 Order Date: 04Nov2005

For: Omni-Test Laboratories 56

Department: NO PO#: OTL-05-067 ONSITE

JJ Calibrations, Inc.

#0723.01

Instrument Identification

Property #: OMNI-00023 Serial #: 010644

Make: METTLER User:

Model: AE200

Noun: SCALE

Accuracy: ±0.01% OF APPLIED WEIGHT

Certification Information

As Found: Within Tolerance Calibration Date: 04Nov2005

As Left: Within Tolerance *Client Specified Due Date: 04May2006

Adjustments: None Repairs: None Seals: N/A Environment: 25°C 49% RH

Procedure: CP 27 Technician: 33

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
256A	RICE LAKE	W0133K	WEIGHT SET	11Aug2008	326425

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 08Nov2005

Rev # 11

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

JJ Calibrations, Inc.

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

Certificate #: 335439
Date: 08Nov2005
Technician: 33
Calibration Interval: 6 Months

Parameter	Nominal	Reference Standard	UUT Before	UUT After	UUT ± Limit	Uncertainty ±
Mass						
	N/A	01 g	1.0001g	1.0000g	0.0001 g	N/A
	N/A	10 g	10.0004g	10.0004g	0.001 g	N/A
	N/A	50 g	50.0010g	50.0010g	0.005 g	N/A
	N/A	100 g	100.0018g	100.0018g	0.010 g	N/A
	N/A	200 g	200.0015g	200.0015g	0.020 g	N/A

Supplement Data Sheet
Bold Italics indicates Out of Tolerance Value.

2 - 18 OF 2 - 52

MICROTECTOR®
Operating & Maintenance Instructions

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.

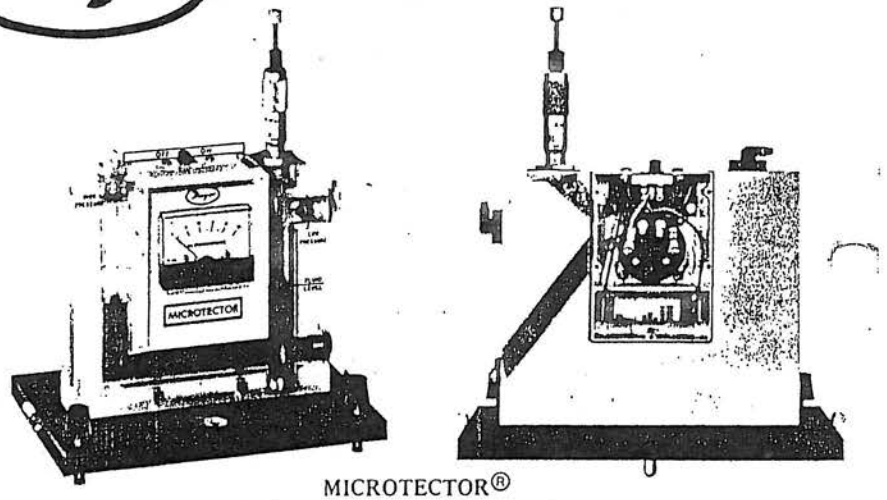
If meter becomes inoperative and cannot be made to operate properly by cleaning point tip or replacing battery, return the entire gage to Dwyer Instruments, Inc., for service.

"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.

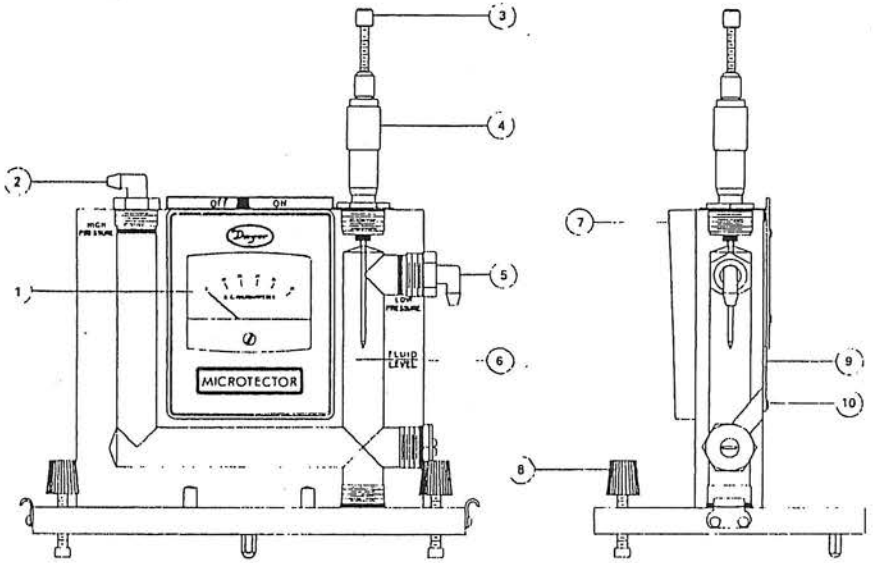
Rugged Sheet Steel Cover and Carrying Case Protects the Entire Unit When Not In Use.

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 on 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.

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.

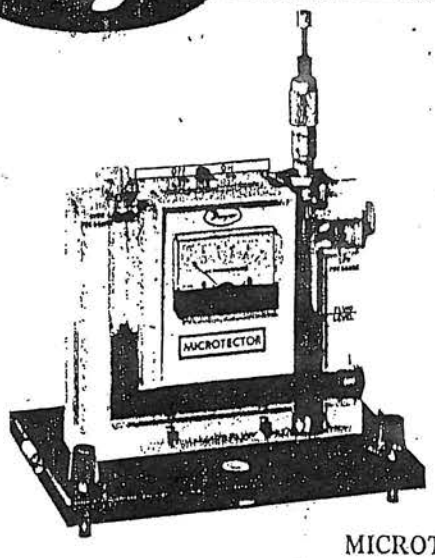
"Microtector" ®
A Product From
Dwyer Instruments, Inc.
"The Low Pressure People"

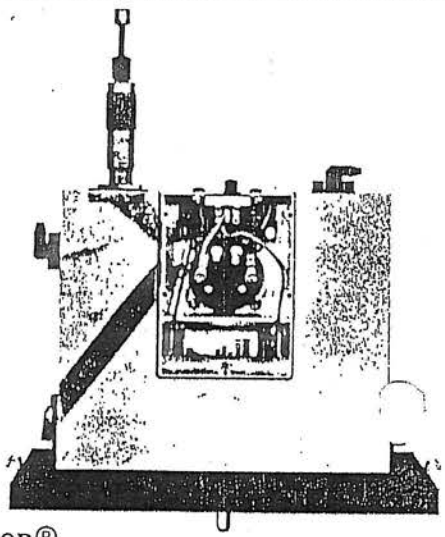
38-440190-00

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

...ICROTECTOR

Operating and Maintenance Instructions





MICROTECTOR®

Specifications and Features*

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

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

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

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

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

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

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

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

Durablock® Precision Machined Acrylic Plastic Gage Body.

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

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

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

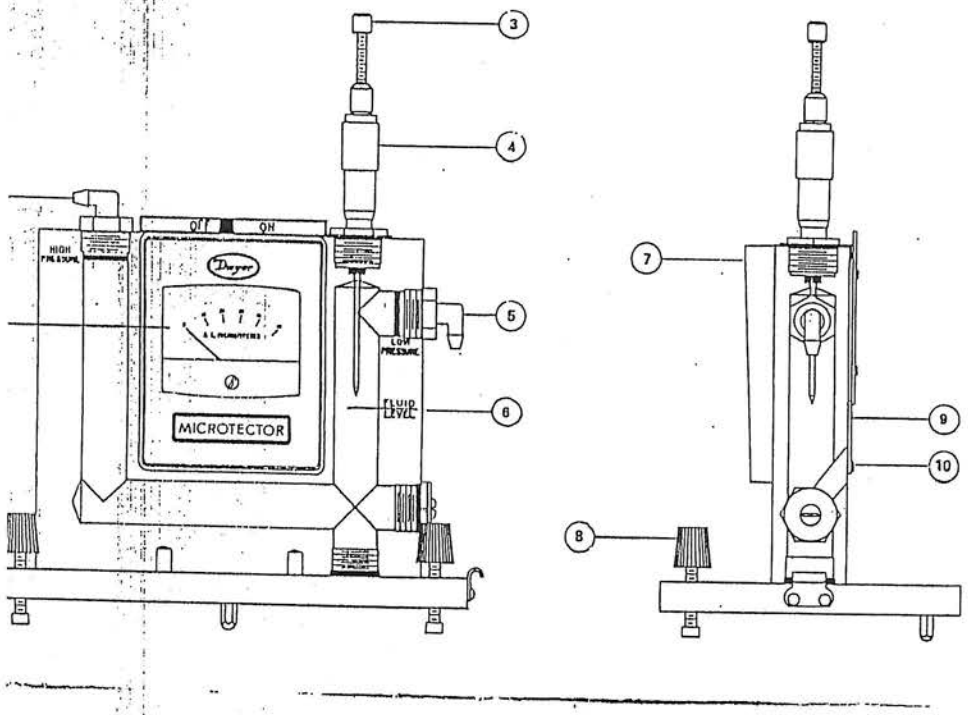
Electronic Enclosure of Tough Molded Styrene Acrylonitrile Provides Maximum Protection to Components Yet Allows Easy Access to Battery Compartment.

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

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

**Patent Applied For*

DWYER INSTRUMENTS, INC.
P. O. BOX 373 • MICHIGAN CITY, INDIANA 46360 U.S.A.
Telephone 219/872-9141 or
Chicago 312/733-7883



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 Comparable results can be obtained either method.

Positive Pressure Measurement

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

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

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

Temperature Calibration
EPA Method 28 and 5G

Booth:	Temperature Monitor Type:	Identification Number:
Emissions	Omega 115 KF	112

Reference Temperature Monitor Type:	Identification Number:
OMEGA Calibrator Model CL300 0117	Serial Number 506

Calibration Performed By:	Date:	Ambient Temperature:	Barometric Pressure:
Jared Sorenson	6-1-06	67	29.82

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	-000	-001	001	-001	-001	-001
100	99	99	99	99	99	98
300	302	302	302	302	302	302
500	501	501	501	501	501	500
700	700	700	700	700	700	700

Technician signature: J. Sorenson Date: 6-1-06

OMNI Environmental Service
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 - 0.25 ID Number: 126

Calibration Instrument: Digital Manometer ID Number: 275

Date: 2-3-06 By: K. Morgan

Only two data points for a between calibration check

Digital Manometer (A) (inches of H_20)	Magnehelic Gauge (B) (inches of H_20)	Difference (A - B)	% Error of Full Span*
0.24	0.2425	-.0025	1.0
0.13	0.1325	-.0025	1.0
0.08	0.0825	-.0025	1.0
0.03	0.0300	Ø	Ø

*Acceptable tolerance is 4%.

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

Technician signature: K. J. Morgan Date: 2-3-06

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

DIFFERENTIAL PRESSURE GAUGE CALIBRATION DATA SHEET
Digital Manometer

Instrument to be calibrated: 0-10" Liquid manometer

Range: 0-10" ID Number: 156

Calibration Instrument: Liquid Manometer ID Number: 275

Date: 11-4-05 By: B Davis

156

Liquid Manometer (A) (inches of H_20)	Digital Manometer (B) (inches of H_20)	Difference (A - B)	% Error of Full Span*
3.0	3.04	.04	
0.9	0.89	.01	
0.55	0.54	.01	
0.20	0.18	.02	

*Acceptable tolerance is 4%.

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

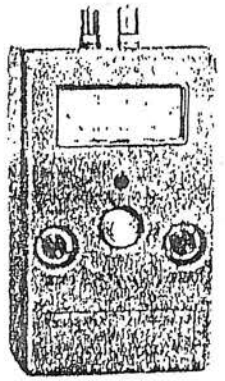
Technician signature: [signature] Date: 11-4-05

2 - 26 OF 2 - 52

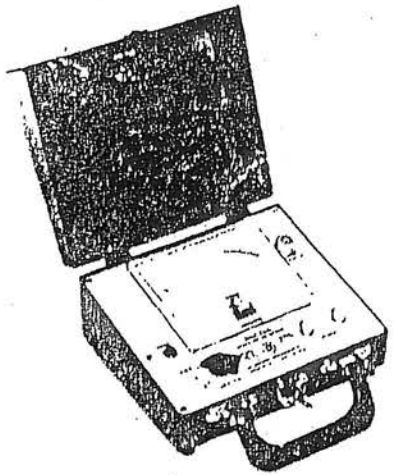
DELMHORST INSTRUMENT COMPANY
BOONTON, N.J. 07005

5074-578

OWNER'S MANUAL



MOISTURE DETECTORS FOR WOOD



DELMHORST INSTRUMENT COMPANY

INDEX

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.

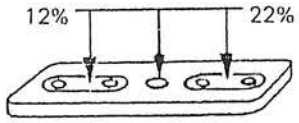
CALIBRATION MOISTURE STANDARDS

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. 1065 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.

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

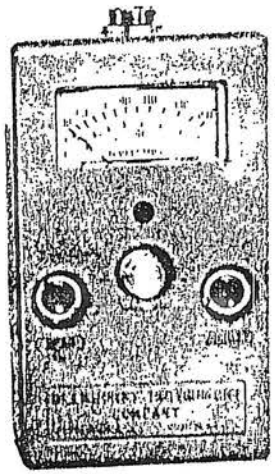
The TM-2 is a solid-state, portable battery operated instrument.

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)

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



TS-2
SENSOR

THE DELMHORST KIL-MO-TROL

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

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

Saves Time — Shows exactly when lumber is dry.

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

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

Appendix 2

MOISTURE CONTENT SCALES

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

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

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

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

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

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

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

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

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

W/ MV: 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. 111991
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
5547		WI-127	1K	10,000 DIV
21876		3030	1K	

COMMENTS

Rental 1 Month

Set up calibration 1000 x 0.1 LB per order 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

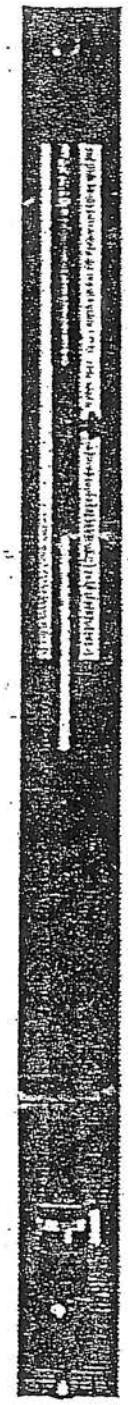
Instruction Booklet

for use with

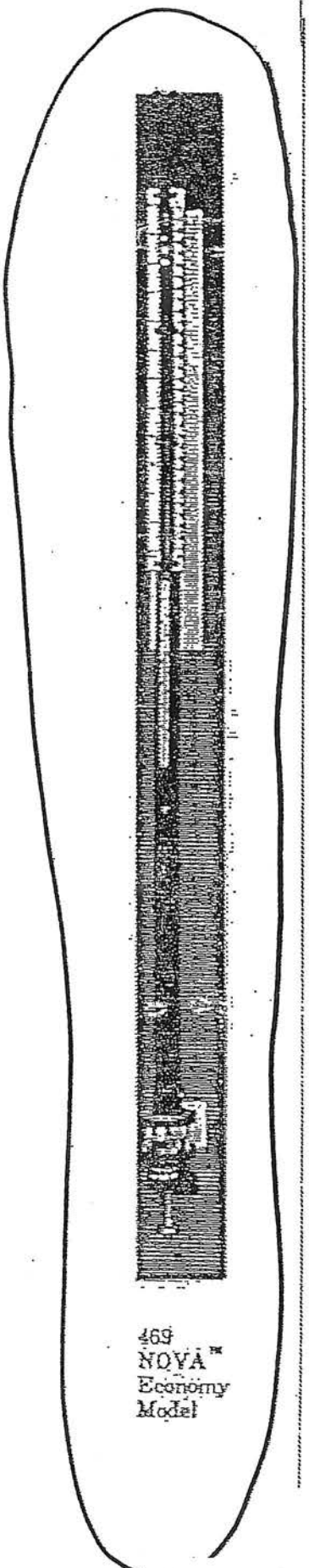
PRINCO

Fortin type mercurial

Barometers



453
National
Weather
Service
Type



469
NOVA™
Economy
Model

Manufactured by

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

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

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 ar
3/14/03	BD	Installed new vane from factory	9/14/03
1-19-04	BD	Installed new vane from factory	7-19-04
7-16-04	BD	Installed new vane from factory	1-16-05
1-16-05	BD	Installed new vane from factory	7-16-05
7-14-05	BD	Installed new vane from factory	1-14-06
1-14-06	BD	Installed new vane from factory	7-14-06
		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	

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

SCALE WEIGHT CALIBRATION DATA SHEET

Weight to be calibrated: ~~10~~ 500 mg

ID Number: ~~00273~~ 00272

Standard Calibration Weight: 500 mg

ID Number: OMNI-00131

Scale Used: ~~00023~~ Mettler AE200 Balance

ID Number: 00023

Date: 12-31-02 By: Jared Solenson

Standard Weight (A) (Lb.)	Weight Verified (B) (Lb.)	Difference (A - B)	% Error
.5001 g	.5003 g	.0002	

*Acceptable tolerance is 1%.

This calibration is traceable to NIST using calibrated standard weights.

Technician signature: [signature] Date: 12-31-~~01~~ 02

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

SCALE WEIGHT CALIBRATION DATA SHEET

Weight to be calibrated: 10 lb

ID Number: OMNI-00274

Standard Calibration Weight: 10 lb

ID Number: OMNI-00255

Scale Used: WEIGH-TRONIX

ID Number: OMNI-00185

Date: 12-31-02 By: Jared Sorenson

Standard Weight (A) (Lb.)	Weight Verified (B) (Lb.)	Difference (A - B)	% Error
10	10	Ø	Ø

*Acceptable tolerance is 1%.

This calibration is traceable to NIST using calibrated standard weights.

Technician signature: [signature] Date: 12-31-02

Certificate of Calibration 340678

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

Cust ID: 56
PO: OTL-06-020
Authorized By:

JJ Calibrations, Inc.

ACCREDITED
0723.01

Make: OMEGA
Model: RH82
Noun: THERMO HYGROMETER
Serial #: 9190156
Property #: OMNI-00291
Department: NO
User:
Procedure: CP 2
Accuracy: Refer to Specifications

Order Date: 02/03/2006
Calibrated on: 02/14/2006
***Recommended Due:** 02/14/2007
Environment: 22 °C 29 % RH
As Received: Within Tolerance
As Returned: Within Tolerance
Action Taken: Calibrated
Technician: 101
ID Barcode: FNLB

Remarks

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

Standards Used

Std ID	Manufacturer	Model	Nomenclature	Due Date	Trace ID
374	FLUKE	5500A-SC300	CALIBRATOR W/300MHz	07/13/2006	321086

This instrument has been calibrated in accordance with the JJ Calibrations Quality Assurance Manual and is traceable to the National Institute of Standards and Technology (NIST). The quality system and this certificate are in compliance with ANSI/NCSL Z540-1-1994, ISO/IEC 17025-1999, ISO 10012-1, ISO 9002 and QS 9000. The expanded uncertainties of measurements for this calibration are based upon 95% (2 sigma) confidence limits. The results reported herein apply only to the calibration of the item described above. This report may not be reproduced, except in full, without written approval of JJ Calibrations.

Jeff Thompson
Manager

Inspector

Issued 02/16/2006 Rev # 12

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

JJ Calibrations, Inc.

Manufacturer: Omega
Model: RH82
Nomenclature: Temp/Humidity Meter
Serial: 0009190156

Certificate #: 340678
Date: 14Feb2006
Technician: 101
Calibration interval: 12Months

Parameter		Reference Standard	UUT Before	UUT After	UUT ± Limit	Uncertainty ±
Humidity Accuracy	33%	33.1%	32.8%	32.8%	2%	N/A
	75%	75.1%	75.4%	75.4%	2%	N/A
Temperature	Ambient	22.00°C	21.4°F	21.4°F	1.0°F	N/A
Accuracy						

Supplement Data Sheet
Bold Italics indicates Out of Tolerance Value.

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

NIST Stopwatch Calibration, Time Proficiency Testing Procedure and Data Sheet

Date: 10 / 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

Example Calculations

Note: *OMNI 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: $85.49 \frac{ft}{\text{sec}} \left[\frac{(lb/lb-mole) \times (inches\ Hg)}{(^oR) \times (inches\ H_2O)}\right]^{\frac{1}{2}}$
C_p	=	Pitot tube coefficient (0.99 for standard pitot tube; 0.84 may be used for S-type pitot tubes constructed according to Method 2 procedures), unitless
ΔP	=	ΔP measured during the pre-test flow traverse of the dilution tunnel; the square root of the ΔP values are averaged for this calculation, in. H_2O
P_b	=	Barometric pressure at test site, in. Hg
P_g	=	Static Pressure of tunnel, in. Hg
P_s	=	Absolute tunnel pressure, $= P_b + P_g$
M_s	=	Molecular weight of tunnel gas; assume M_d =29 lb/lb-mole (per method 5G)
B_{ws}	=	Moisture content of dilution tunnel gas, ratio; assume 4% (per method 5G)
T_s	=	Dilution tunnel temperature, °R; (°R = °F + 460)

Sample calculation:

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

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

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

Particulate Concentration

Using equation 5G-2:

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

Where:

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

Sample calculation:

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

$$C_s = 0.000163 \ g/dscf$$

Average Dilution Tunnel Gas Flow Rate

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

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

Where:

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

Sample calculation:

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

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

Particulate Emission Rate

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

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

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

Where:

E = Particulate emission rate, g/hr

E_{adj} = Particulate emission rate, adjusted, g/hr

C_s = Concentration of particulate matter in the stack, corrected to dry, standard conditions, g/dscf

Q_{sd} = Average dilution tunnel gas flow rate, dscf/hr

K_3 = Constant, 1.82 for metric units, 0.643 for English units

Sample calculation:

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

$$E = 1.36 \ g/hr$$

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

$$E = 2.35 \ g/hr$$

Proportional Rate Variation

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

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

Where:

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

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

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

$$PR = 103.8\%$$

Section 3

Owner's Manual

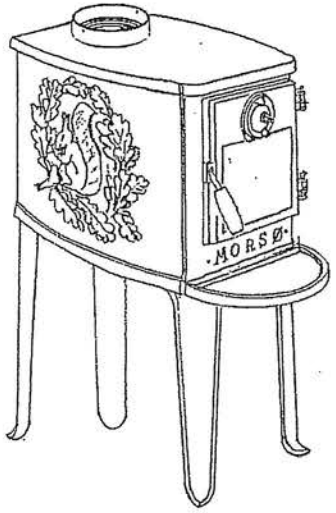
morsø

By appointment to the Royal Danish Court

Installation and Operating Instructions

2B Standard

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

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 2B Classic meets the U.S. Environmental Protection Agency's emission limits for wood heaters sold on or after July 1, 1990

The Morsø 2B Classic have been tested by OMNI-Test Laboratories, Inc. The test standards are ANSI/UL-1482 for the United States and ULC S627 for Canada.

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

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

3 - 3 OF 3 - 12

Contents:

1.0 Installation of your Morsø stove

Installation of woodburning stoves must be safe and legal.

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

Before you start installing your stove, make sure that:

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

All neccessary approvals are needed from the local building officials.

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

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

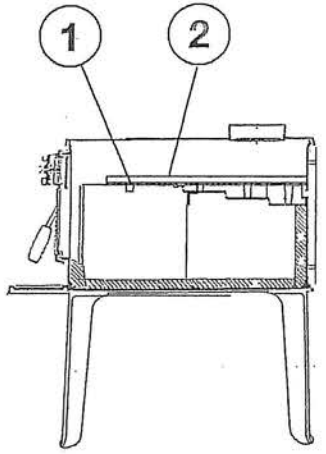
Do not connect to any air distribution duct or system.

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

1.1 Checking loose parts in the stove

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

Before starting the initial fire, make sure that the baffle (1) and insulation (2) over the baffle placed correctly, as shown on the images below.



Standard Accessories

A Morsø glove and ceramic flue connection gasket are standard accessories that usually 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).

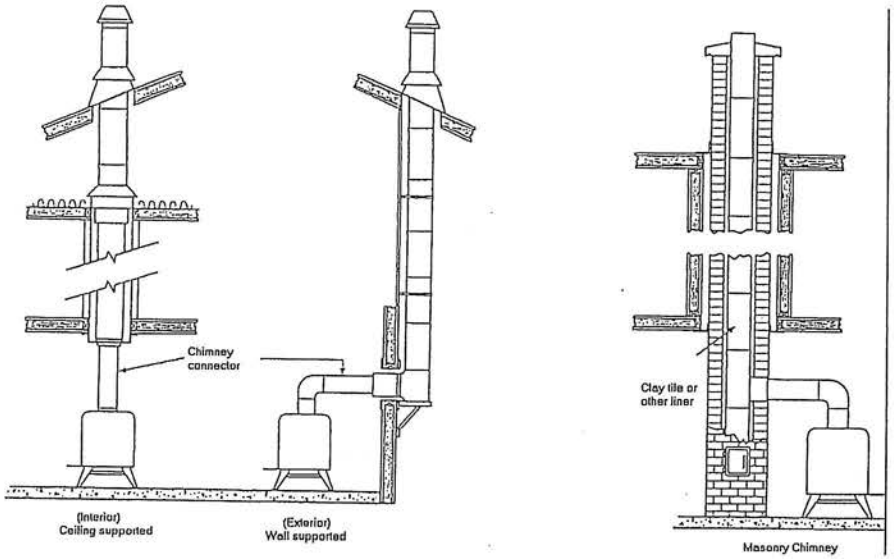
Use a residential type masonry or listed type HT factory-built chimney.

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



3 - 5 OF 3 - 12

1.3 Flue Connection

A flue collar are placed in the firebox area.

Use a 24 MSG black or blue chimney connector or listed double wall chimney connector. I
to local codes and the chimney manufacturer's instructions for precautions required for pas
a chimney through a combustible wall or ceiling. Remember to secure the chimney conn
with a minimum of three screws to the product and to each adjoining section.
Position the stove and connect to the flue system.

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

1.4 Connection to the existing chimney

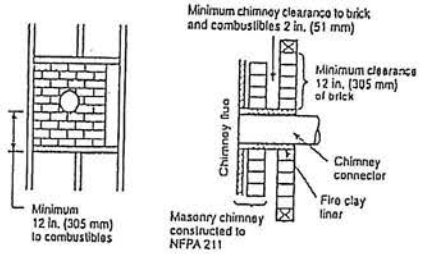
A chimney connector is the double-wall or single-wall pipe that connects the stove to chim-
ney. The chimney itself is the masonry or prefabricated structure that encloses the flue. C
ney connectors are used only to connect the stove to the chimney.
Double-wall connectors must be tested and listed for use with solid-fuel burning appliar
Single-wall connectors should be made of 24 gauge or heavier gauge steel. Do not use g
nized connector; it cannot withstand the high-temperatures that smoke and exhaust gases
reach, and may release toxic furnes under high heat. The connector must be 6 inches (150
in diameter.

**If possible, do not pass the chimney connector through a combustible wall or ceilin
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.**

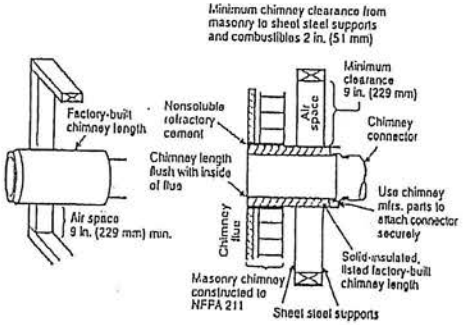
It is important to keep the flue gases moving smoothly in the right direction. Do not vent ir
large void at this location; rather form one continuous section all the way up. Use mild b
(e.g. 45° vs. 90°) rather than sharp angles where a change of direction is required. All par
the venting must be accessible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

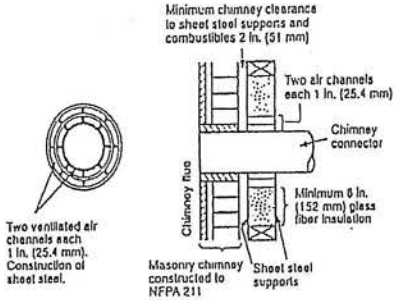
Where passage through a wall or partition of combustible construction is desired, the installa
shall conform to CAN/CSA-B365.



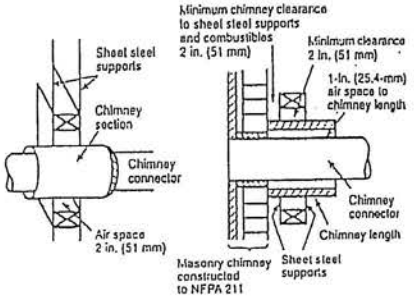
A Minimum 3.5-in thick brick masonry all framed into combustible wall with a minimum of 12-in brick separation from clay liner to combustibles. The fireclay liner shall run from outer surface of brick wall to, but not beyond, the inner surface of chimney flue liner and shall be firmly cemented in place.



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



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



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

3 - 6 OF 3 - 12

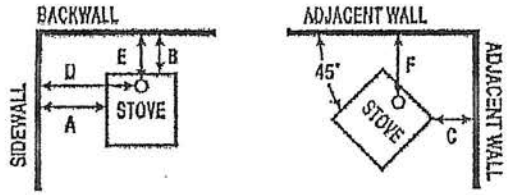
1.5 Positioning the stove

Distance to walls and lintel

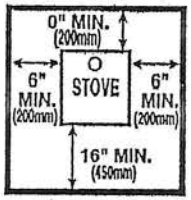
When the stove is positioned near combustible materials, observe all current local and na
building regulations with regards to clearances. Whatever regulations apply to your are
not in any case install the stove within 8 inches of combustible materials around the sic
16 inches above the top of the stove (fireplace installations require greater clearances
the stove - see below in the clearance chart). These distances may need to be increased
materials are sensitive to heat. Note also that wall paper and other decorative materials
become detached with the effects of heat and care should be taken to ensure that they c
fall towards the stove in such an event.
When the stove is positioned near non-combustible materials, a gap of 4 inches or m
recommended for cleaning purposes and to ensure that heat circulates around the stov
out into the room.

CLEARANCE REQUIREMENTS:	STANDARD RESIDENTIAL INSTALLATION (SINGLEWALL & DOUBLEWALL CONNECTO	
	USA	Canada
A. SIDEWALL TO UNIT	XXX	XXX
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:



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

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.

Do NOT install in a mobile home

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 Connec Glows You Are Overfiring. Inspect and Clean Chimney Frequently. Under Certain Conditions of use creosote buildup may occur rapidly. Because of risk of smoke a flame spillage, operate only with door fully closed.

Caution:

Hot while in operation. Keep children, clothing and furniture away. Contact m 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 similar liquids to start or freshen up a fire in this heater. Keep all such liquids aw 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 an Once the wood is cut to length, it should be split down middle - to suit the dimensions 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 c section. If you can weigh your wood, aim for around 2 Lbs. The maximum moisture conte the wood should be around 20%.

Store the logs under cover in a location where fresh air can move through the stack. Some woods may take as little as one good summer to season whereas harder woods such as maple, and elm may require seasoning up to 18 months. Avoid overly dry wood that is in color as it can cause performance problems, such as backpuffing and sluggishness, u certain conditions. Well seasoned wood will be remarkably light to hold and will probably radial cracking at the ends. If your wood spits or sizzles when burnt, and your stove's glass persistently mists up, your wood is not properly seasoned. Never use drift wood the sea), whose salt content may cause corrosion, nor construction wood that may have impregnated with chemicals.

Caution: Do not place fuel within the installation clearances for the stove or with 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 the stove can settle into position. Some fumes will be given off by the paint. Ventila the room during this phase.

The setting of the air control, lighting techniques and loading intervals will depe on chimney draft, the fuel used, the heat required and so on. Some basic techniqu are outlined below.

In principle

Your stove is fitted wih Primary and Secondary air inlets.

Primary Air is controlled using the spinner on the door. Open the spinner will allow a supp preheated air to enter the firebox via the 'airwash' system situated inside the stove and a 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 on the frontdoor.

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 frontdoor, 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 frontdoor should be closed. A suitable layer of ember will be formed after a about 15-20 minutes.
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.
7. Close the frontdoor. 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 s will not respond, a poor draft is almost certainly to blame. (In a very few cases, there m insufficient fresh air getting into the room - see installation advice above). Take advice from 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 impo 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 wo 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

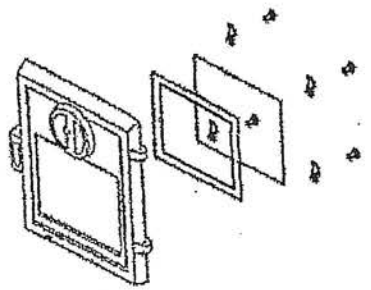
- **Fuel too wet**
- **Logs too large or not split**
- **Combustion temperatures too low**

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. Lift the door off the hinges and place it face down on a sheet of cardboard or ot nonabrasive fabric.

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

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

4. Place the new gasket material in position around the perimeter of the window area, mak sure to pinch them to the length in such a way that they make a continuous seal. Leave gaps.

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

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

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

Internal service parts

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

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 tha maged 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 effic 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
Open the front door, and use a shovel.

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.

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 sche
To inspect the chimney, let the stove cool completely. Then, using a mirror, sight up throug flue collar into the chimney flue. If you cannot inspect the flue system in this fashion, the 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 bru and down the liner, causing any deposits to fall to the bottom of the chimney where the be removed through the clean-out door.
Clean the chimney connector disconnecting the sections, taking them outside, and rem any deposits with a stiff wire brush. Reinstall the connector sections after cleaning, being 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 fessional 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 prefabri 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.

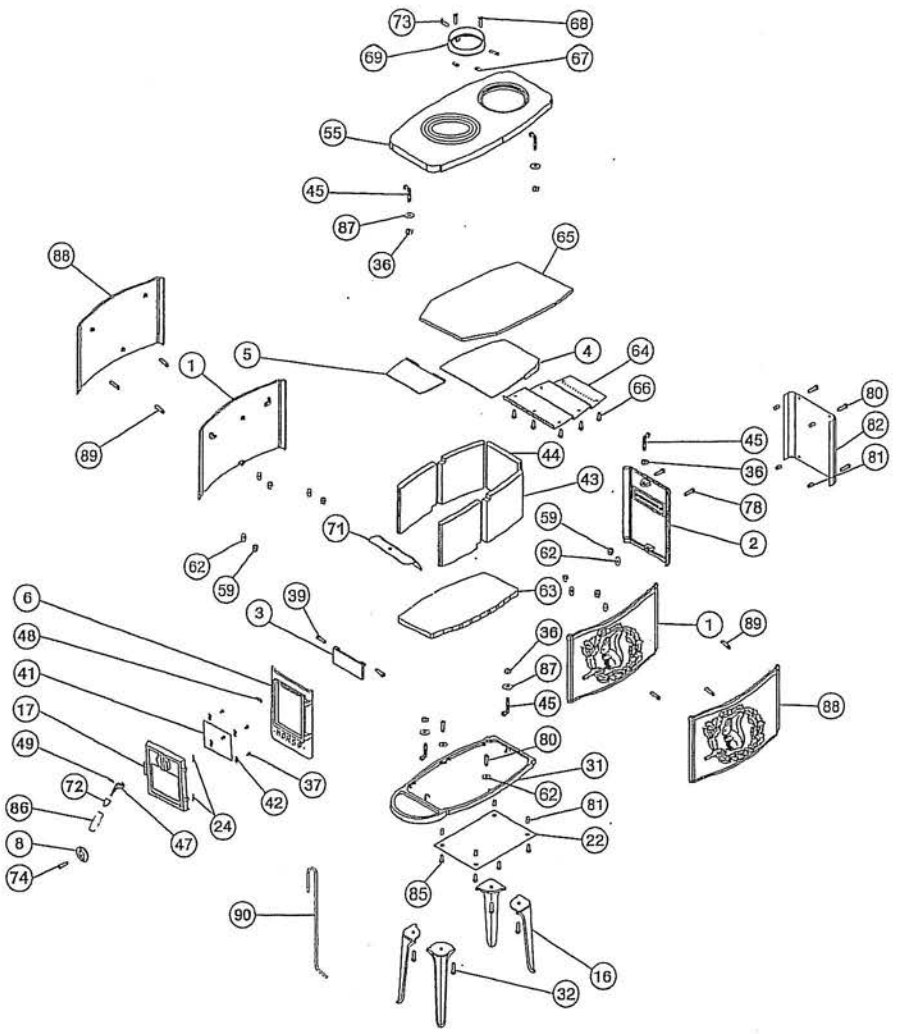
3.4 Leaving the stove for extended periods

Important:
If the stove is to be left unused for any period of time, clean it out thoroughly and leave t control slightly open to allow airflow. Make sure that the flue does not allow rainwater to 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 th 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 all to settle within the stove, rust will form. Rust expands as it takes a grip. This can lead to u 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. A a dessicant, such as kitter litter, into the ash pan helps absorb moisture during the su 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 experimen with loading and running techniques will decide your normal routine. If you have any pro after this short learning phase, please refer to your stove dealer. Should they be unable t for any reason, please contact us in writing at the address on the front of this publication

3.5 Parts diagram for model Morsø 2B Standard



3.6 Parts list for model Morsø 2B Standard

Pos.No.	Parts	
1	Squirrel side panel	4420XX21
2	Rear plate	44203721
3	Smoke valve	44200800
4	Horizontal baffle	44203600
5	Vertical baffle	44203800
6	Front	44201521
8	Air controle	44202221
16	Leg	44200121
17	Door	44204421
20	Poker	541075
22	Radiation shield - base	54137000
24	Hinge pin	541808
31	Base	5420XX00
32	Screw	-
36	Screw	-
37	Screw	-
39	Screw	-
41	Door glass	790715
42	Glass clips	790743
43	Side brick	790932
44	Rear brick	790933
45	Bolt	-
47	Clasp	79127000
48	Pin	791868
49	Pin	791869
62	Washer	-
63	Brick - bace	7920XX00
64	Baffle - standless steel	71209061
65	Insulation	79077100
66	Screw	-
67	Fitting for cover w. thread	44256700
68	Screw	-
69	Flue collar	44145921
71	Radiation shield - front	71209161
72	Fitting for handle	44256800
73	Screw	-
74	Screw	-
77	Tightning tape for glass	79074200
78	Screw	-
80	Screw	-
81	Distance tube	542635
82	Conv. back rear plate	54201221
84	Screw	-
85	Screw	-
86	Bakelite handle 36 mm	79118300
87	Washer	-
88	Konv. Squirrel side panel	5420XX21
89	Screw	-
90	Poker	541075

Section 4

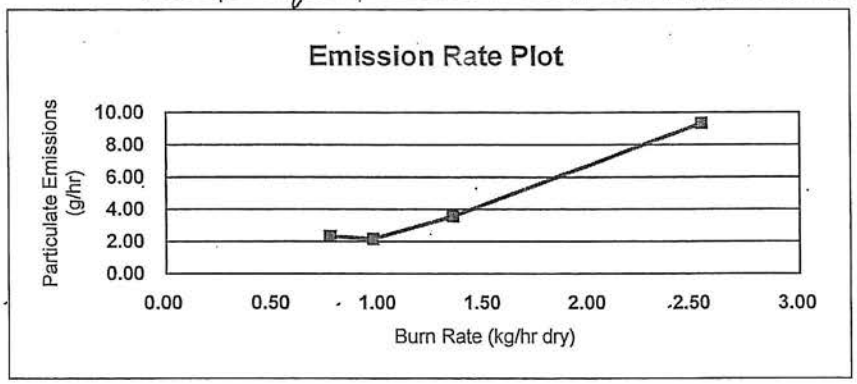
Test Data by Run

EPA Weighted Average Emissions
EPA Method 28

Client: Morso
Stove Model: 2B
Test Dates: 7/18/06 - 7/19/06
Project Number: 192-S-09-3
Tracking Number: 879
Signature/Date: K. J. Morgan 7-24-06

Status: FINAL
Stove Type: Non-Catalytic Stove

Weighted Average (g/hr)
4.1



Run #	1	
Burn Rate (dry kg/hr)	0.77	
Catagory	1	
Overall Efficiency (%)	63%	
Emissions (g/hr)	2.32	
Cap (g/hr)	15	
Weighting Factor	0.349	19.73%
Heat Output (BTU/hr)	9304	
Run #	3	
Burn Rate (dry kg/hr)	0.97	
Catagory	2	
Overall Efficiency (%)	63%	
Emissions (g/hr)	2.17	
Cap (g/hr)	15	
Weighting Factor	0.455	25.73%
Heat Output (BTU/hr)	11721	
Run #	4	
Burn Rate (dry kg/hr)	1.35	
Catagory	3	
Overall Efficiency (%)	63%	
Emissions (g/hr)	3.57	
Cap (g/hr)	15	
Weighting Factor	0.618	34.97%
Heat Output (BTU/hr)	16313	
Run #	2	
Burn Rate (dry kg/hr)	2.54	
Catagory	4	
Overall Efficiency (%)	63%	
Emissions (g/hr)	9.32	
Cap (g/hr)	18	
Weighting Factor	0.346	19.57%
Heat Output (BTU/hr)	30692	

Run 1

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Run:	1
Manufacturer:	Morso
Model:	2B
Tracking No.:	879
Project No.:	192-S-09-3
Test Date:	18-Jul-06
Beginning Clock Time:	10:00
Recording Interval:	10 min.
Total Sampling Time:	160 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	0.036	0.036	0.030	0.034	0.038	0.034	0.028	"H2O
Initial Temp.	88	87	87	87	87	87	87	87	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:	-0.560	"H2O
Pitot Tube Cp:	0.99	
Meter Box Y Factor:	0.991	

Barometric Pressure:	Begin	Middle	End	Average
	30.12	30.1	30.07	30.10 "Hg

Signature/Date: JW 8-1-06

Tunnel Velocity:	12.33	ft/sec.
Intial Tunnel Flow:	134.7	scfm
Average Tunnel Flow:	134.7	scfm
Tunnel Area:	0.196	ft2
Post-Test Leak Check:	.012 @ 10	cfm@"Hg
Fuel Moisture (dry basis	19.42	%
Total Particulate:	13.0	mg
Filter Holder No.:		

Elapsed Time	Particulate Sampling Data								Fuel Weight, lb		Wood Heater Temperature Data, oF											Stack	
	Gas Meter Cubic Feet	Sample Rate, cfm	Orifice dH	Meter oF	Meter Vac. In. Hg.	Dilution Tunnel Temp.	Dilution Tunnel dP	Pro. Rate (10%)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Filter	Impinger exit	Ambient	Draft In. H2O	Catalyst Temp.
0	54.200		0.00	69	0	87	0.033		5.4		428	413	471	426	441		435.8	241	71	65	66	-0.028	
10	59.340	0.51	0.75	81	1	100	0.033	104	4.2	-1.2	659	430	450	411	421		474.2	352	74	44	69	-0.053	
20	64.480	0.51	0.75	90	1	98	0.033	102	3.1	-1.1	719	410	449	407	408		478.6	343	75	44	69	-0.053	
30	69.710	0.52	0.75	97	1	95	0.033	102	2.0	-1.1	724	374	453	407	410		473.6	328	76	44	69	-0.050	
40	74.880	0.52	0.75	101	1	94	0.033	100	1.3	-0.7	691	352	461	412	418		466.8	292	76	44	71	-0.043	
50	80.100	0.52	0.75	103	1	91	0.033	101	1.0	-0.3	570	341	463	421	430		445.0	236	76	44	70	-0.033	
60	85.400	0.53	0.75	105	1	88	0.033	101	0.9	-0.1	483	340	456	418	428		425.0	209	76	44	69	-0.030	
70	90.650	0.53	0.75	107	1	87	0.033	100	0.8	-0.1	424	344	442	403	415		405.6	193	73	46	69	-0.025	
80	95.900	0.53	0.75	108	1	86	0.033	100	0.7	-0.1	394	347	427	389	401		391.6	183	75	47	70	-0.025	
90	101.150	0.53	0.75	109	1	85	0.033	99	0.6	-0.1	376	348	409	376	389		379.6	177	75	47	69	-0.023	
100	106.340	0.52	0.75	110	1	85	0.033	98	0.6	0	364	348	397	368	383		372.0	173	75	48	71	-0.023	
110	111.610	0.53	0.75	110	1	84	0.033	100	0.5	-0.1	353	348	386	359	377		364.6	170	75	48	69	-0.023	
120	116.910	0.53	0.75	111	1	84	0.033	100	0.4	-0.1	345	347	376	350	372		358.0	167	75	49	70	-0.020	
130	122.210	0.53	0.75	111	1	84	0.033	100	0.3	-0.1	338	345	368	344	367		352.4	165	75	49	70	-0.020	
140	127.525	0.53	0.75	112	1	84	0.033	100	0.2	-0.1	329	344	360	337	361		346.2	162	75	49	70	-0.020	
150	132.805	0.53	0.75	112	1	84	0.033	99	0.1	-0.1	322	342	353	330	355		340.4	159	75	49	70	-0.020	
160	138.107	0.53	0.75	113	1	85	0.033	100	0.0	-0.1	318	343	349	325	350		337.0	157	75	50	70	-0.018	
Avg/Total	83.907	0.52	0.71	102.88		88.30	0.033	100.41									99		74.82	47.71		-0.030	#DIV/0!

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Manufacturer: Morso
Model: 2B
Project No.: 879
Tracking No.: 192-S-09-3
Run: 1
Test Date: 07/18/06

Burn Rate	0.77 kg/hr dry
Particulate Concentration (dry-standard) Particulate Emission Rate Adjusted Emissions	0.00017 grams/dscf 1.34 grams/hour 2.32 grams/hour
Average Tunnel Temperature	88 degrees Fahrenheit
Average Delta p	0.033 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	83.91 cubic feet 103 degrees Fahrenheit 12.33 feet/second 8082.05 dscf/hour 78.59 dscf
Total Particulates - mn Average Delta H Total Time of Test	13 mg 0.71 inches H20 160 minutes

K. J. Morgan
7-26-06

OMNI-Test Laboratories, Inc.

Final Laboratory Report - Method 5G
Dilution Tunnel Particulate Calculations

Client Name: Morso
Model: 2B
Project No.: 192-S-09-3
Tracking No.: 879
Equipment Numbers:
Run #: 1
Date: 07/18/06

Sample Component	Reagent	Filter # or Volume, ml	Weights			
			Final, mg	Tare, mg	Blank, mg/ml	Particulate, mg
A. Front filter catch	Filter	N150	569.6	561.3		8.3
B. Rear filter catch	Filter	N149	586.7	586.7		0.0
C. Rinse of probe and filter assembly	Acetone	75	106572.3	106567.4	0.0024	4.7

Total Particulate, mg :	13.0

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: K. J. Morgan Date: 7-20-06

Wood Heater Test Data - EPA Method 5G Preburn

Run: 1

Manufacturer: Morso
Model: 2B
Tracking No.: 879
Project No.: 192-S-09-3
Preburn Date: 7/18/2006

Recording Interval: 10 min.

Coal Bed Range: 1.1 - 1.3
Actual Coal Bed: 1.2

Signature/Date: L. Morgan 7-26-06

OMNI Equipment Numbers: 0
0
0

Elapsed Time	Fuel Weight, lb		Wood Heater Temperature Data, oF									Stack	
	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Ambient	Draft In. H2O	Catalyst Temp.
0	4.8		928	389	395	418	416	0	509.2	589	69	-0.075	NA
10	3.6	-1.2	759	367	422	440	429	0	483.4	364	68	-0.058	NA
20	2.6	-1	724	353	434	446	434	0	478.2	335	68	-0.053	NA
30	1.9	-0.7	696	350	452	449	438	0	477.0	307	68	-0.048	NA
40	1.5	-0.4	589	358	477	446	446	0	463.2	256	68	-0.038	NA
50	1.3	-0.2	502	377	476	437	444	0	447.2	219	67	-0.033	NA
60	1.2	-0.1	455	404	472	428	442	0	440.2	202	67	-0.028	NA
Avg/Total									471			-0.048	#DIV/0!

4 - 7 OF 4 - 34

OMNI-Test Laboratories, Inc
Beaverton, OR

FUEL DATA

Client: Morso
Model: 2B
Project #: 192-S-09-3 Tracking #: 879
Date: 7-18-07 Test Crew: K. Morgan Run #: 1
OMNI Equipment ID #:
FUEL LOAD PREPARED BY: K. Morgan
FUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER, DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER – – DRY BASIS)

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

Piece	Length		Readings			Type
1	8 ft	21.2	19.1	19.6		2x4
2	____ ft					
3	____ ft					

Length of cut pieces: 4@16 2@8 inches Pre-Burn Fuel Average Moisture: 19.97 %

Time (clock): 08:15 Room Temperature (F): 69 Initials: K

TEST FUEL

FUEL TYPE AND AMOUNT: 2 × 4 3 4 × 4 0
CALCULATED LOAD WEIGHT: 5.642 ACTUAL LOAD WEIGHT: 5.4 (2 × 4)
0 (4 × 4)
FUEL PIECE LENGTH: 15.0" 5.4 Total

MOISTURE CONTENT (METER – – DRY BASIS)

PIECE	READINGS			TYPE
1	19.0	18.6	20.0	2x4
2	19.7	19.7	19.8	2x4
3	19.3	18.7	20.0	2x4
4				
5				
6				
7				
8				
9				
10				

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 19.42 %

Time (clock): 08:30 Room Temperature (F): 69 Initials: K

Technician signature: K. Morgan Date: 7-18-07

OMNI-Test Laboratories, Inc.
Beaverton, OR

Run Notes

Client/Model: Morso
Model: 2B
Project #: 192-S-09-3
Tracking Number: 879
Run #: 1 Date: 7-18-06
Test Crew: K. Morgan
OMNI Equipment ID Numbers:

PREBURN

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

PRIMARY:

Spin Draft Open - 1.0 Revolution

SECONDARY: Fixed

TERTIARY: None

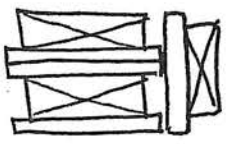
FAN: None - N/A

PREBURN SETTINGS AND ACTIVITIES

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

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)



START UP PROCEDURES

BYPASS: N/A
FUEL LOADING: Loaded by 60 sec.
DOOR: AJAR until 4.0 min
PRIMARY AIR: Full open until 4:15 – slowly adjusted to set test setting from 4:15 – 5:00.
OTHER: None

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

PRIMARY:

Same As Above

SECONDARY: Fixed

TERTIARY: None

FAN: None

Technician signature: K. Morgan Date: 7-18-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Supplemental Data EPA 5G/5H

Client: Morso

Model: 2B

Project No.: 192-S-09-3 Tracking No.: 879

Date: 7-18-06 Run No.: 1 Booth: 1

Test Crew: K. Morgan Start Time: 10:00 Stop Time: 12:40

OMNI Equipment #'s:

Gas Analyzer Train Leak Check:

Stack: Dilution Tunnel (Method 5G Only):

Initial: Initial:

Final: N/A Final: N/A

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

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

Stack Diameter (inches): 5.0"

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

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

Induced Draft: Ø %Smoke Capture: 100

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

Flue Pipe Cleaned Prior to First Test in Series: Date: 7-17-06 Initials: IL

	Initial	Middle	Ending
Pb (in. Hg)	30.12	30.10	30.07
Room Temp (°F)	66	69	70

Technician signature: K. J. Morgan Date: 7-18-06

Run 2

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Run: 2

Signature/Date: JW 8-1-06

Manufacturer:	Morso		
Model:	2B		
Tracking No.:	879		
Project No.:	192-S-09-3		
Test Date:	18-Jul-06		
Beginning Clock Time:	14:30		
Recording Interval:	10	min.	
Total Sampling Time:	50	min.	

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
Initial dP	0.038	0.042	0.036	0.028	0.030	0.038	0.042	0.030	"H2O
Initial Temp.	130	130	130	130	130	130	130	130	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:	0.991		

Barometric Pressure:	Begin	Middle	End	Average
	30.05	30.05	30.05	30.05 "Hg

Tunnel Velocity:	13.24	ft/sec.
Intial Tunnel Flow:	133.7	scfm
Average Tunnel Flow:	133.9	scfm
Tunnel Area:	0.196	ft2
Post-Test Leak Check:	.014 @ 10	cfm@"Hg
Fuel Moisture (dry basis	20.01	%
Total Particulate:	22.0	mg
Filter Holder No.:		

Elapsed Time	Particulate Sampling Data								Fuel Weight, lb		Wood Heater Temperature Data, oF											Stack	
	Gas Meter Cubic Feet	Sample Rate, cfm	Orifice dH	Meter oF	Meter Vac. In. Hg.	Dilution Tunnel Temp.	Dilution Tunnel dP	Pro. Rate (10%)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Filter	Impinger exit	Ambient	Draft In. H2O	Catalyst Temp.
0	138.600		0.00	76	0	130	0.036		5.6		643	399	562	500	538		528.4	422	78	70	76	-0.060	
10	143.800	0.52	0.75	89	1	146	0.036	103	3.5	-2.1	1004	460	553	493	518		605.6	718	82	48	78	-0.090	
20	149.010	0.52	0.75	98	1	142	0.036	101	1.8	-1.7	1014	452	547	499	509		604.2	644	85	49	77	-0.083	
30	154.250	0.52	0.75	104	1	134	0.036	100	0.7	-1.1	925	433	560	520	518		591.2	565	87	49	77	-0.078	
40	159.500	0.53	0.75	109	1	120	0.036	98	0.3	-0.4	641	428	574	527	521		538.2	441	87	49	76	-0.065	
50	164.775	0.53	0.75	111	1	114	0.036	98	0.0	-0.3	571	434	568	505	505		516.6	413	86	50	76	-0.063	
Avg/Total	26.175	0.52	0.63	97.83		131.00	0.036	100.02									12		84.17	52.50		-0.073	#DIV/0!

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Manufacturer: Morso
Model: 2B
Project No.: 879
Tracking No.: 192-S-09-3
Run: 2
Test Date: 07/18/06

Burn Rate	2.54	kg/hr dry
Particulate Concentration (dry-standard)	0.00089	grams/dscf
Particulate Emission Rate	7.16	grams/hour
Adjusted Emissions	9.32	grams/hour
Average Tunnel Temperature	131	degrees Fahrenheit
Average Delta p	0.036	inches H20
Total Sample Volume - Vm	26.18	cubic feet
Average Gas Meter Temperature	98	degrees Fahrenheit
Average Gas Velocity in Dilution Tunnel - vs	13.24	feet/second
Average Gas Flow Rate in Dilution Tunnel - Qsd	8036.57	dscf/hour
Total Sample Volume (Standard Conditions) - Vms	24.70	dscf
Total Particulates - mn	22	mg
Average Delta H	0.63	inches H20
Total Time of Test	50	minutes

7-26-06

OMNI-Test Laboratories, Inc.

Final Laboratory Report - Method 5G
Dilution Tunnel Particulate Calculations

Client Name: Morso
Model: 2B
Project No.: 192-S-09-3
Tracking No.: 879

Equipment Numbers:

Run #: 2
Date: 07/18/06

Sample Component	Reagent	Filter # or Volume, ml	Weights			
			Final, mg	Tare, mg	Blank, mg/ml	Particulate, mg
A. Front filter catch	Filter	N152	544.5	526.7		17.8
B. Rear filter catch	Filter	N151	565.8	567.3		-1.5
C. Rinse of probe and filter assembly	Acetone	100	104832.7	104826.8	0.0024	5.7

Total Particulate, mg :	22.0

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: K. L. Morgan Date: 7-20-06

Wood Heater Test Data - EPA Method 5G Preburn

Run: 2

Manufacturer: Morso
Model: 2B
Tracking No.: 879
Project No.: 192-S-09-3
Preburn Date: 7/18/2006

Recording Interval: 10 min.

Coal Bed Range: 1.2 - 1.4
Actual Coal Bed: 1.4

Signature/Date: [signature] 7-26-06

OMNI Equipment Numbers: 0
0
0

Elapsed Time	Fuel Weight, lb		Wood Heater Temperature Data, oF									Stack	
	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Ambient	Draft In. H2O	Catalyst Temp.
0	9.5		284	348	333	319	331	0	323.0	206	72	-0.028	NA
10	8.6	-0.9	549	343	302	302	308	0	360.8	485	73	-0.065	NA
20	7.4	-1.2	703	319	276	303	302	0	380.6	544	74	-0.070	NA
30	6	-1.4	775	292	288	339	335	0	405.8	573	74	-0.075	NA
40	4.3	-1.7	893	280	360	399	397	0	465.8	608	75	-0.078	NA
50	3	-1.3	883	289	416	440	435	0	492.6	584	75	-0.078	NA
60	1.9	-1.1	858	322	493	481	488	0	528.4	563	75	-0.075	NA
70	1.4	-0.5	704	384	553	499	533	0	534.6	478	77	-0.065	NA
Avg/Total									436			-0.067	#DIV/0!

4 - 15 OF 4 - 34

OMNI-Test Laboratories, Inc
Beaverton, OR

FUEL DATA

Client: Morso
Model: 2B
Project #: 192-S-09-3 Tracking #: 879
Date: 7-18-06 Test Crew: K. Morgan Run #: 2
OMNI Equipment ID #:
FUEL LOAD PREPARED BY: K. Morgan
FUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER, DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER – – DRY BASIS)

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

Piece	Length		Readings		Type
1	8 ft	21.2	19.4	19.8	2x4
2	ft				
3	ft				

Length of cut pieces: 4@16 4@8 inches Pre-Burn Fuel Average Moisture: 20.13 %

Time (clock): 13:15 Room Temperature (F): 70 Initials: IL

TEST FUEL

FUEL TYPE AND AMOUNT: 2 × 4 3 4 × 4 0
CALCULATED LOAD WEIGHT: 5.642 ACTUAL LOAD WEIGHT: 5.6 (2 × 4)
0 (4 × 4)
FUEL PIECE LENGTH: ~~16.0~~ 15.0" 5.6 Total

MOISTURE CONTENT (METER – – DRY BASIS)

PIECE	READINGS			TYPE
1	20.8	20.9	20.9	2x4
2	20.6	19.2	19.0	2x4
3	19.9	19.7	19.1	2x4
4				
5				
6				
7				
8				
9				
10				

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 20.01 %

Time (clock): 13:25 Room Temperature (F): 70 Initials: IL

Technician signature: K. J. Morg Date: 7-18-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Run Notes

Client/Model: Morso
Model: 2B
Project #: 192-S-09-3
Tracking Number: 879
Run #: 2 Date: 7-18-06
Test Crew: K. Morgan
OMNI Equipment ID Numbers:

PREBURN

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

PRIMARY:

Fully OPEN
(5.0 Revolutions)

SECONDARY: FIXED

TERTIARY: NONE

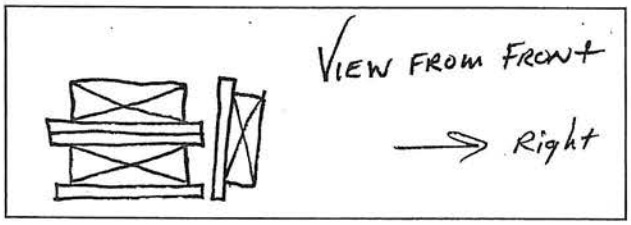
FAN: NONE - N/A

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
~~0~~ 70	TEST setting				X	Levelled

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)



START UP PROCEDURES

BYPASS: N/A
FUEL LOADING: Loaded by 40 SECONDS
DOOR: Closed at 50 seconds
PRIMARY AIR: Fully open Duration of Test.
OTHER: None

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

SAME AS ABOVE

SECONDARY: FIXED

TERTIARY: NONE

FAN: NONE - N/A

Technician signature: K. J. Morgan Date: 7-18-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Supplemental Data EPA 5G/5H

Client: Morso

Model: 2B

Project No.: 192-S-09-3 Tracking No.: 879

Date: 7-18-06 Run No.: 2 Booth: 1

Test Crew: K. Morgan Start Time: 14:30 Stop Time: 15:20

OMNI Equipment #'s:

Gas Analyzer Train Leak Check:

Stack: Dilution Tunnel (Method 5G Only):

Initial: Initial:

Final: N/A Final: N/A

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

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

Stack Diameter (inches): 5.0

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

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

Induced Draft: Ø %Smoke Capture: 100

Pitot Tube Leak Test: Pre: Ø @ 3.1 "W.C Post: Ø @ 3.2 "W.C.

Flue Pipe Cleaned Prior to First Test in Series: Date: 7-17-06 Initials: JK

	Initial	Middle	Ending
Pb (in. Hg)	30.05	30.05	30.05
Room Temp (°F)	76	77	76

Technician signature: K. Morgan Date: 7-18-06

Run 3

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Run:	3
Manufacturer:	Morso
Model:	2B
Tracking No.:	879
Project No.:	192-S-09-3
Test Date:	19-Jul-06
Beginning Clock Time:	10:35
Recording Interval:	10 min.
Total Sampling Time:	130 min.

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
Initial dP	0.034	0.038	0.034	0.036	0.032	0.038	0.038	0.028	"H2O
Initial Temp.	92	92	92	92	92	92	92	92	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:	-0.560	"H2O		
Pitot Tube Cp:	0.99			
Meter Box Y Factor:	0.991			
Barometric Pressure:	Begin	Middle	End	Average
	29.97	29.97	29.96	29.97 "Hg

Signature/Date: JW 8-1-06

Tunnel Velocity:	12.71	ft/sec.
Intial Tunnel Flow:	136.8	scfm
Average Tunnel Flow:	136.6	scfm
Tunnel Area:	0.196	ft2
Post-Test Leak Check:	.012 @ 10	cfm@"Hg
Fuel Moisture (dry basis	20.93	%
Total Particulate:	9.6	mg
Filter Holder No.:		

Elapsed Time	Particulate Sampling Data								Fuel Weight, lb		Wood Heater Temperature Data, oF											Stack	
	Gas Meter Cubic Feet	Sample Rate, cfm	Orifice dH	Meter oF	Meter Vac. In. Hg.	Dilution Tunnel Temp.	Dilution Tunnel dP	Pro. Rate (10%)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Filter	Impinger exit	Ambient	Draft In. H2O	Catalyst Temp.
0	165.400		0.00	72	0	92	0.035		5.6		488	445	480	445	448		461.2	286	74	69	72	-0.040	
10	170.580	0.52	0.75	84	1	107	0.035	104	4.3	-1.3	694	448	452	427	436		491.4	414	78	49	71	-0.063	
20	175.780	0.52	0.75	93	1	105	0.035	102	3.0	-1.3	778	426	452	419	437		502.4	420	79	48	72	-0.063	
30	181.050	0.53	0.75	100	1	104	0.035	102	1.9	-1.1	793	392	465	426	450		505.2	405	80	48	74	-0.060	
40	186.300	0.53	0.75	104	1	101	0.035	101	1.2	-0.7	728	371	484	441	462		497.2	367	81	49	74	-0.055	
50	191.500	0.52	0.75	107	1	96	0.035	99	0.9	-0.3	594	365	502	455	463		475.8	304	81	49	73	-0.048	
60	196.795	0.53	0.75	109	1	93	0.035	100	0.8	-0.1	498	368	509	448	451		454.8	270	80	50	72	-0.043	
70	202.100	0.53	0.75	112	1	91	0.035	100	0.7	-0.1	440	379	498	426	428		434.2	248	79	51	73	-0.038	
80	207.460	0.54	0.75	112	1	91	0.035	101	0.6	-0.1	424	380	488	417	419		425.6	242	79	53	73	-0.035	
90	212.710	0.53	0.75	113	1	90	0.035	98	0.5	-0.1	409	382	474	404	408		415.4	235	79	54	74	-0.035	
100	218.030	0.53	0.75	114	1	90	0.035	100	0.4	-0.1	389	381	461	390	397		403.6	227	79	55	74	-0.033	
110	223.350	0.53	0.75	115	1	89	0.035	99	0.3	-0.1	375	378	450	380	387		394.0	221	79	56	74	-0.033	
120	228.665	0.53	0.75	115	1	89	0.035	99	0.2	-0.1	362	375	437	371	376		384.2	216	79	57	74	-0.033	
130	233.990	0.53	0.75	116	1	89	0.035	99	0.0	-0.2	352	370	430	360	367		375.8	212	79	60	74	-0.033	
Avg/Total	68.590	0.53	0.70	104.71		94.79	0.035	100.36									85		79.00	53.43		-0.044	#DIV/0!

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Manufacturer: Morso
Model: 2B
Project No.: 879
Tracking No.: 192-S-09-3
Run: 3
Test Date: 07/19/06

Burn Rate	0.97 kg/hr dry
Particulate Concentration (dry-standard) Particulate Emission Rate Adjusted Emissions	0.00015 grams/dscf 1.23 grams/hour 2.17 grams/hour
Average Tunnel Temperature	95 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) - Vms	68.59 cubic feet 105 degrees Fahrenheit 12.71 feet/second 8196.13 dscf/hour 63.76 dscf
Total Particulates - mn Average Delta H Total Time of Test	9.6 mg 0.70 inches H20 130 minutes

K. J. Morgan
7-26-06

OMNI-Test Laboratories, Inc.

Final Laboratory Report - Method 5G
Dilution Tunnel Particulate Calculations

Client Name: Morso
Model: 2B
Project No.: 192-S-09-3
Tracking No.: 879

Equipment Numbers:

Run #: 3
Date: 07/19/06

Sample Component	Reagent	Filter # or Volume, ml	Weights			
			Final, mg	Tare, mg	Blank, mg/ml	Particulate, mg
A. Front filter catch	Filter	N154	577.8	572.6		5.2
B. Rear filter catch	Filter	N153	583.1	583.9		-0.8
C. Rinse of probe and filter assembly	Acetone	75	103429.2	103423.8	0.0024	5.2

Total Particulate, mg :	9.6

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: K. J. Morgan Date: 7-24-06

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G Preburn

Run: 3

Manufacturer: Morso
Model: 2B
Tracking No.: 879
Project No.: 192-S-09-3
Preburn Date: 7/19/2006

Recording Interval: 10 min.

Coal Bed Range: 1.2 - 1.4
Actual Coal Bed: 1.2

Signature/Date: K. J. Morgan 7-26-06

OMNI Equipment Numbers: 0
0
0

Elapsed Time	Fuel Weight, lb		Wood Heater Temperature Data, oF									Stack	
	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Ambient	Draft In. H2O	Catalyst Temp.
0	5.6		767	407	366	413	410	0	472.6	520	69	-0.073	NA
10	4.4	-1.2	734	386	358	420	414	0	462.4	413	70	-0.063	NA
20	3.1	-1.3	823	386	360	438	422	0	485.8	436	70	-0.065	NA
30	2	-1.1	792	411	388	463	441	0	499.0	404	70	-0.060	NA
40	1.4	-0.6	654	443	438	477	464	0	495.2	333	71	-0.050	NA
50	2.3	0.9	601	448	466	469	461	0	489.0	341	71	-0.055	NA
60	1.8	-0.5	590	442	479	456	454	0	484.2	316	70	-0.050	NA
70	1.4	-0.4	546	441	480	448	450	0	473.0	291	70	-0.045	NA
80	1.2	-0.2	517	445	480	446	448	0	467.2	274	72	-0.043	NA
Avg/Total									481			-0.056	#DIV/0!

4 - 23 OF 4 - 34

OMNI-Test Laboratories, Inc.
Beaverton, OR

FUEL DATA

Client: Morso
Model: 2B
Project #: 192-S-09-3 Tracking #: 879
Date: 7-19-06 Test Crew: K. Morgan Run #: 3
OMNI Equipment ID #:
FUEL LOAD PREPARED BY: K. Morgan
FUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER, DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER – – DRY BASIS)

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

Piece	Length		Readings		Type
1	8 ft	22.5	21.8	23.2	2x4
2	____ ft				
3	____ ft				

Length of cut pieces: ~~2@8~~ 4@16 inches Pre-Burn Fuel Average Moisture: 22.5%

Time (clock): 09:00 Room Temperature (F): 69 Initials: JL

TEST FUEL

FUEL TYPE AND AMOUNT: 2 × 4 3 4 × 4 ~~0~~
CALCULATED LOAD WEIGHT: 5.642 ACTUAL LOAD WEIGHT: 5.6 (2 × 4)
~~0~~ (4 × 4)
FUEL PIECE LENGTH: 15.0 5.6 Total

MOISTURE CONTENT (METER – – DRY BASIS)

PIECE	READINGS			TYPE
1	22.5	21.0	21.5	2x4
2	21.0	21.5	19.4	2x4
3	21.5	19.5	20.5	2x4
4				
5				
6				
7				
8				
9				
10				

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 20.93%

Time (clock): 09:00 Room Temperature (F): 69 Initials: JL

Technician signature: K. Morgan Date: 7-19-06

OMNI-Test Laboratories Inc.
Beaverton, OR

Run Notes

Client/Model: Morso
Model: 2B
Project #: 192-S-09-3
Tracking Number: 879
Run #: 3 Date: 7-19-06
Test Crew: K. Morgan
OMNI Equipment ID Numbers:

PREBURN

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

PRIMARY:

OPEN 1.5 Revolutions
(SPIN-DRAFT)

SECONDARY: FIXED

TERTIARY: NONE

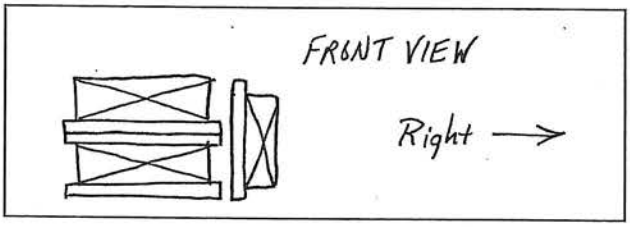
FAN: NONE

PREBURN SETTINGS AND ACTIVITIES

TIME	AIR (THERMO) CHANGES PRIMARY/SECONDARY/TERTIARY	FAN SETTING CHANGE	ADD FUEL + WT.	ADD FUEL - WT.	RAKE COAL	COMMENT
0	TEST Setting					
35					X	STIRRED
45			1.6			
80					X	Levelled

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)



START UP PROCEDURES

BYPASS: N/A
FUEL LOADING: Loaded by 1 min.
DOOR: AJAR UNTIL 4.0 min.
PRIMARY AIR: Slow Adjust From 4:25 min to 5.0 min.
OTHER: NONE.

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

SAME AS ABOVE

SECONDARY: FIXED

TERTIARY: NONE

FAN: NONE

Technician signature: K. J. Morgan Date: 7-19-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Supplemental Data EPA 5G/5H

Client: Morso

Model: 2B

Project No.: 192-S-09-3 Tracking No.: 879

Date: 7-19-06 Run No.: 3 Booth: 1

Test Crew: K. Morgan Start Time: 10:35 Stop Time: 12:45

OMNI Equipment #'s:

Gas Analyzer Train Leak Check:

Stack: Dilution Tunnel (Method 5G Only):

Initial: Initial:

Final: N/A Final: N/A

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

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

Stack Diameter (inches): 5.0

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

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

Induced Draft: 0 %Smoke Capture: 100

Pitot Tube Leak Test: Pre: 0 @ 3.1 "w.c. Post: 0 @ 3.2"w.c

Flue Pipe Cleaned Prior to First Test in Series: Date: 7-17-06 Initials: JL

	Initial	Middle	Ending
Pb (in. Hg)	29.97	29.97	29.96
Room Temp (°F)	~~74~~ 72 AG	72	74

Technician signature: K. J. Morgan Date: 7-19-06

Run 4

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Run:	4
Manufacturer:	Morso
Model:	2B
Tracking No.:	879
Project No.:	192-S-09-3
Test Date:	19-Jul-06
Beginning Clock Time:	15:30
Recording Interval:	10 min.
Total Sampling Time:	90 min.

Velocity Traverse Data

	Pt.1	Pt.2	Pt.3	Pt.4	Pt.5	Pt.6	Pt.7	Pt.8	
Initial dP	0.034	0.038	0.034	0.028	0.030	0.038	0.038	0.032	"H2O
Initial Temp.	123	124	124	124	123	123	123	123	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:	-0.610	"H2O		
Pitot Tube Cp:	0.99			
Meter Box Y Factor:	0.991			
Barometric Pressure:	Begin	Middle	End	Average
	29.94	29.94	29.94	29.94 "Hg

Signature/Date: JW 8-4-06

Tunnel Velocity:	12.84	ft/sec.
Intial Tunnel Flow:	131.5	scfm
Average Tunnel Flow:	132.3	scfm
Tunnel Area:	0.196	ft2
Post-Test Leak Check:	.008 @ 10	cfm@"Hg
Fuel Moisture (dry basis	21.33	%
Total Particulate:	12.5	mg
Filter Holder No.:		

Elapsed Time	Particulate Sampling Data								Fuel Weight, lb		Wood Heater Temperature Data, oF											Stack	
	Gas Meter Cubic Feet	Sample Rate, cfm	Orifice dH	Meter oF	Meter Vac. In. Hg.	Dilution Tunnel Temp.	Dilution Tunnel dP	Pro. Rate (10%)	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Filter	Impinger exit	Ambient	Draft In. H2O	Catalyst Temp.
0	234.400		0.00	81	0	123	0.034		5.4		546	447	533	497	502		505.0	362	82	74	79	-0.055	
10	239.680	0.53	0.75	94	1	131	0.034	104	3.8	-1.6	841	468	500	468	481		551.6	548	81	50	80	-0.080	
20	244.915	0.52	0.75	102	1	131	0.034	102	2.4	-1.4	858	445	501	464	477		549.0	537	81	50	80	-0.078	
30	250.210	0.53	0.75	108	1	130	0.034	102	1.2	-1.2	875	421	516	473	484		553.8	529	81	49	81	-0.075	
40	255.515	0.53	0.75	113	1	121	0.034	100	0.7	-0.5	681	406	541	490	493		522.2	430	81	51	80	-0.065	
50	260.815	0.53	0.75	115	1	114	0.034	99	0.5	-0.2	553	408	545	483	484		494.6	373	81	51	81	-0.058	
60	266.120	0.53	0.75	117	1	110	0.034	99	0.4	-0.1	485	417	534	461	464		472.2	343	80	53	80	-0.055	
70	271.480	0.54	0.75	118	1	108	0.034	99	0.3	-0.1	453	422	519	440	442		455.2	329	79	54	81	-0.053	
80	276.820	0.53	0.75	119	1	107	0.034	99	0.1	-0.2	436	422	506	426	425		443.0	322	80	54	80	-0.053	
90	282.185	0.54	0.75	120	1	106	0.034	99	0.0	-0.1	421	422	493	414	410		432.0	310	83	54	80	-0.050	
Avg/Total	47.785	0.53	0.68	108.70		118.14	0.034	100.19									73		80.90	54.00		-0.062	#DIV/0!

OMNI-Test Laboratories, Inc.

Wood Heater Test Data - EPA Method 5G

Manufacturer: Morso
Model: 2B
Project No.: 879
Tracking No.: 192-S-09-3
Run: 4
Test Date: 07/19/06

Burn Rate	1.35 kg/hr dry
Particulate Concentration (dry-standard) Particulate Emission Rate Adjusted Emissions	0.00028 grams/dscf 2.25 grams/hour 3.57 grams/hour
Average Tunnel Temperature	118 degrees Fahrenheit
Average Delta p	0.034 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	47.79 cubic feet 109 degrees Fahrenheit 12.84 feet/second 7937.76 dscf/hour 44.07 dscf
Total Particulates - mn Average Delta H Total Time of Test	12.5 mg 0.68 inches H20 90 minutes

7-26-06

OMNI-Test Laboratories, Inc.

Final Laboratory Report - Method 5G
Dilution Tunnel Particulate Calculations

Client Name: Morso
Model: 2B
Project No.: 192-S-09-3
Tracking No.: 879

Equipment Numbers:

Run #: 4
Date: 07/19/06

Sample Component	Reagent	Filter # or Volume, ml	Weights			
			Final, mg	Tare, mg	Blank, mg/ml	Particulate, mg
A. Front filter catch	Filter	N158	552.7	544.3		8.4
B. Rear filter catch	Filter	N157	573.5	574.2		-0.7
C. Rinse of probe and filter assembly	Acetone	75	103046.1	103041.1	0.0024	4.8

Total Particulate, mg :	12.5

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

Analyst: K. J. Morgan Date: 7-24-06

Wood Heater Test Data - EPA Method 5G Preburn

Run: 4

Manufacturer: Morso
Model: 2B
Tracking No.: 879
Project No.: 192-S-09-3
Preburn Date: 7/19/2006

Recording Interval: 10 min.

Coal Bed Range: 1.1 - 1.3
Actual Coal Bed: 1.2

Signature/Date: K. J. Morgan 7-26-06

OMNI Equipment Numbers: 0
0
0

Elapsed Time	Fuel Weight, lb		Wood Heater Temperature Data, oF									Stack	
	Scale Reading	Weight Change	Firebox Top	Firebox Bottom	Firebox Back	Firebox Left	Firebox Right	Firebox Interior	Average Surface	Stack	Ambient	Draft In. H2O	Catalyst Temp.
0	10.4		268	337	361	309	308	0	316.6	251	76	-0.043	NA
10	9.7	-0.7	450	327	309	281	282	0	329.8	353	76	-0.053	NA
20	8.9	-0.8	538	310	282	279	272	0	336.2	404	77	-0.060	NA
30	7.9	-1	641	284	258	293	279	0	351.0	477	77	-0.068	NA
40	6.7	-1.2	701	270	255	331	323	0	376.0	496	77	-0.070	NA
50	5.3	-1.4	819	273	279	382	375	0	425.6	548	80	-0.075	NA
60	4	-1.3	827	292	334	424	431	0	461.6	524	80	-0.075	NA
70	3	-1	818	320	399	456	466	0	491.8	512	80	-0.073	NA
80	2.1	-0.9	784	360	463	483	495	0	517.0	487	80	-0.070	NA
90	1.6	-0.5	663	406	512	498	505	0	516.8	428	79	-0.063	NA
100	1.2	-0.4	602	433	527	499	504	0	513.0	394	79	-0.060	NA
Avg/Total									421			-0.710	#DIV/0!

4 - 3 1 OF 4 - 3 4

OMNI-Test Laboratories, Inc.
Beaverton, OR

FUEL DATA

Client: Morso
Model: 2B
Project #: 192-S-09-3 Tracking #: 879
Date: 7-19-06 Test Crew: K. MORGAN Run #: 4
OMNI Equipment ID #: _____
FUEL LOAD PREPARED BY: K. MORGAN
FUEL: DOUGLAS-FIR SPECIES, UNTREATED, AIR-DRIED, STANDARD GRADE OR BETTER, DIMENSIONAL LUMBER.

PRE-BURN FUEL

MOISTURE CONTENT (METER -- DRY BASIS)

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

Piece	Length		Readings		Type
1	8 ft	23.2	23.8	22.8	2x4
2	____ ft	____	____	____	____
3	____ ft	____	____	____	____

Length of cut pieces: 4@16 4@8 inches Pre-Burn Fuel Average Moisture: 23.27%

Time (clock): 09:00 Room Temperature (F): 69 Initials: IL

TEST FUEL

FUEL TYPE AND AMOUNT: 2 × 4 3 4 × 4 0
CALCULATED LOAD WEIGHT: 5.642 ACTUAL LOAD WEIGHT: 5.4 (2 × 4)
0 (4 × 4)
FUEL PIECE LENGTH: 15.0 5.4 Total

MOISTURE CONTENT (METER -- DRY BASIS)

PIECE	READINGS			TYPE
1	23.0	23.0	24.5	2 x 4
2	20.0	19.5	20.0	2 x 4
3	22.0	20.0	20.0	2 x 4
4	____	____	____	____
5	____	____	____	____
6	____	____	____	____
7	____	____	____	____
8	____	____	____	____
9	____	____	____	____
10	____	____	____	____

OVERALL TEST FUEL LOAD MOISTURE AVERAGE: 21.33%

Time (clock): 09:00 Room Temperature (F): 69 Initials: IL

Technician signature: K. J. Morgan Date: 7-19-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Run Notes

Client/Model: Morso
Model: 2B
Project #: 192-S-09-3
Tracking Number: 879
Run #: 4 Date: 7-19-06
Test Crew: K. Morgan
OMNI Equipment ID Numbers: _____

PREBURN

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

PRIMARY:

OPEN ~~2.5~~ 3.5 1/2 TURNS
(SPIN-DRAFT)

SECONDARY: FIXED

TERTIARY: NONE

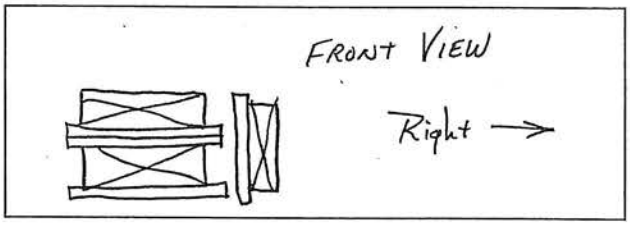
FAN: NONE

PREBURN SETTINGS AND ACTIVITIES

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

TEST

TEST FUEL CONFIGURATION SKETCH
(INDICATE VIEW ANGLE)



START UP PROCEDURES

BYPASS: N/A
FUEL LOADING: Loaded by 40 sec.
DOOR: AJAR UNTIL 3.0 MIN
PRIMARY AIR: Fully open until 4.5 min
Abruptly set to test setting at 4.5 min.
OTHER: NONE

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

PRIMARY:

SAME AS ABOVE

SECONDARY: FIXED

TERTIARY: NONE

FAN: NONE

Technician signature: K. Morgan Date: 7-19-06

OMNI-Test Laboratories, Inc.
Beaverton, OR

Supplemental Data EPA 5G/5H

Client: Morso

Model: 2B

Project No.: 192-S-09-3 Tracking No.: 879

Date: 7-19-06 Run No.: 4 Booth: 1

Test Crew: K. Morgan Start Time: 15:30 Stop Time: 17:00

OMNI Equipment #'s:

Gas Analyzer Train Leak Check:

Stack: Dilution Tunnel (Method 5G Only):

Initial: Initial:

Final: N/A Final: N/A

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

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

Stack Diameter (inches): 5.0

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

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

Induced Draft: Ø %Smoke Capture: 100

Pitot Tube Leak Test: Pre: Ø @ 5.1 "w.c. Post: Ø @ 5.1 "w.c.

Flue Pipe Cleaned Prior to First Test in Series: Date: 7-17-06 Initials: JL

	Initial	Middle	Ending
Pb (in. Hg)	29.94	29.94	29.94
Room Temp (°F)	79	80	80

Technician signature: K. Morgan Date: 7-19-06

Section 5

Sampling Procedures and Test Results

INTRODUCTION

Morsø Jernstøberi A/S retained *OMNI* to perform U.S. Environmental Protection Agency (EPA) certification testing on the model 2B wood stove. The 2B wood stove is a non-catalytic, freestanding, radiant-type room heater. The firebox is constructed of cast iron. The usable firebox volume was measured to be 0.806 cubic feet. The stove is vented through a 5" diameter flue collar located at the top of the unit.

The testing was performed at *OMNI*'s testing facility in Beaverton, Oregon. The altitude of the laboratory is 204 feet above sea level. The unit was received in good condition and logged in on June 26, 2006, then assigned and labeled with *OMNI* ID #879. *OMNI* representative Ken Morgan conducted the certification testing and completed all testing by July 19, 2006. The EPA was notified of the testing dates in a letter dated June 28, 2006. A testing contract, including provisions for Random Compliance Audit (RCA) testing, has been signed by Karsten Aagaard of Morsø Jernstøberi A/S and is on file at *OMNI*'s testing facility.

The 2B wood stove was tested in accordance with the U.S. EPA 40 CFR Part 60, Subpart AAA – Standard of Performance for Residential Wood Heaters (Appendix A, Methods 28 and 5G). Particulate emissions were measured using a Method 5G sampling train consisting of two filters (front and back). The weighted average emissions of the four test runs included in the results indicate a particulate emission level of 4.1 grams per hour. Test runs were conducted in each of four burn rate categories (<0.80 kg/hr, 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 2B 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.
- "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.

Table 1.1 – Particulate Emissions

Run	Burn Rate (kg/hr dry)	Method 5G Emissions (g/hr)
1	0.77	2.32
2	2.54	9.32
3	0.97	2.17
4	1.35	3.57
Weighted particulate emission average of four test runs: 4.1 grams per hour.		

Table 1.2 – Test Facility Conditions

Run	Room Temperature (°F)		Barometric Pressure (Hg)		Air Velocity (ft/min)	
	Before	After	Before	After	Before	After
1	66	70	30.12	30.07	<50	<50
2	76	76	30.05	30.05	<50	<50
3	72	74	29.97	29.96	<50	<50
4	79	80	29.94	29.94	<50	<50

Table 1.3.1 – Fuel Measurement and Crib Description Summary – PRETEST

Run	Pretest Fuel Weight (Starting weight in lbs)	Pretest Moisture (Dry basis - %)	Coal Bed Weight (lbs)
1	4.8	20.0%	1.2
2	9.5	20.1%	1.4
3	5.6	22.5%	1.2
4	10.4	23.3%	1.2

Table 1.3.2 – Fuel Measurement and Crib Description Summary – TEST

Run	Test Fuel Wet Basis (lbs)	Firebox Volume (ft^3)	Fuel Loading Density Wet Basis (lbs/ft^3)	Fuel Moisture Content Dry (%)	Piece Length (in)	2x4s Used	4x4s Used
1	5.4	0.806	6.70	19.4%	15.0	3	0
2	5.6	0.806	6.95	20.0%	15.0	3	0
3	5.6	0.806	6.95	20.9%	15.0	3	0
4	5.4	0.806	6.70	21.3%	15.0	3	0

Table 1.4 – Dilution Tunnel Gas Measurements and Sampling Data Summary

Run	Length of Test (min)	Average Dilution Tunnel Gas Measurements		
		Velocity (ft/sec)	Flow Rate (dscf/min)	Temperature (°F)
1	160	12.3	134.7	88.3
2	50	13.2	133.9	131.0
3	130	12.7	136.6	94.8
4	90	12.8	132.3	118.1

Table 1.5 - Heater Operation Data (Average Temperature Data)

Run	Beginning Surface Temperature Average[a]	Ending Surface Temperature Average[a]	Surface Delta T[b]
1	435.8	337.0	99
2	528.4	516.6	12
3	461.2	375.8	85
4	505.0	432.0	73
a. All temperatures are in degrees F.			
b. Represents the difference between beginning and ending average surface temperatures.			

Table 1.6 – Pretest Configuration

Run	Combustion Air	Fuel Added	Fuel Removed	Time (min)
1	Spin draft open 1.0 revolution	4.8 lbs at start; no addition; coal bed 1.2 lbs	0	60
2	Spin draft fully open (5.0 revolutions)	9.5 lbs at start; no addition; coal bed 1.4 lbs	0	70
3	Spin draft open 1.5 revolutions	5.6 lbs at start; 1.6 lbs. added; coal bed 1.2 lbs	0	80
4	Spin draft open 3.5 revolutions	10.4 lbs at start; no addition; coal bed 1.2 lbs	0	100

Table 1.7 – Run Data

Run	Average Dry Burn Rate (kg/hr)	Initial (Induced) Draft (H_2O)	Primary Air Setting (in)	Run Time (min)	Average Draft (H_2O)
1	0.77	0	Spin draft open 1.0 revolution	160	-0.030
2	2.54	0	Spin draft fully open (5.0 revolutions)	50	-0.073
3	0.97	0	Spin draft open 1.5 revolutions	130	-0.044
4	1.35	0	Spin draft open 3.5 revolutions	90	-0.062

Table 1.8 – Test Configurations

Run	Five-Minute Startup	Combustion Air
1	Bypass: N/A. Fuel Loading: Loaded by 60 seconds. Door: Ajar until 4.0 minutes. Primary Air: Fully open until 4.25 minutes, adjusted to test setting by 5.0 minutes. Other: None. Secondary: Fixed. Tertiary: None. Fan: None.	Spin draft open 1.0 revolution
2	Bypass: N/A. Fuel Loading: Loaded by 40 seconds. Door: Closed at 50 seconds. Primary Air: Fully open. Other: None. Secondary: Fixed. Tertiary: None. Fan: None.	Spin draft fully open (5.0 revolutions)
3	Bypass: N/A. Fuel Loading: Loaded by 1 minute. Door: Ajar until 4.0 minutes. Primary Air: Fully open until 4.25 minutes, adjusted to test setting by 5.0 minutes. Other: None. Secondary: Fixed. Tertiary: None. Fan: None.	Spin draft open 1.5 revolutions
4	Bypass: N/A. Fuel Loading: Loaded by 40 seconds. Door: Ajar until 3.0 minutes. Primary Air: Fully open until 4.5 minutes, then abruptly set to test setting. Other: None. Secondary: Fixed. Tertiary: None. Fan: None.	Spin draft open 3.5 revolutions

TEST RESULTS AND DISCUSSION

A total of four test runs were performed on the 2B wood stove. Four test runs were conducted in the following categories and included in the weighted average emission level results: one in the <0.80 kg/hr dry category; one 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 4.1 g/hr.

The proportionality results for all four test runs were acceptable. Quality check results for each test run are presented in Section 2 of this report.