Intertek Testing Services
ETL SEMKO
8431 Murphy Drive
Middleton, WI 53562

ITS TEST REPORT #J20049092, 3005306
TEST OF A WOOD BURNING STOVE
FOR EMISSIONS AND EFFICIENCY
PER EPA METHOD 28 AND 5G-3
MODEL: 3600
FOR
MORSO JERNSTOBERI
DK-7900
NYKOBING MORS, DENMARK
REPORT DATE: 15 AUGUST, 2001

ITS Intertek Testing Services

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FOR

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MODEL: 3600

FOR

MORSO JERNSTOBERI
NYKOBING MORS, DENMARK

TESTED BY:

INTERTEK TESTING SERVICES NA INC.
8431 MURPHY DRIVE
MIDDLETON, WISCONSIN 53562

TEST DATES: August 8-9, 2001
REPORT DATE: August 15, 2001

VI. QUALITY ASSURANCE

I. INTRODUCTION

I.A. GENERAL

From August 6 through 9, 2001 Intertek Testing Services NA Inc. (ITS) conducted tests on Morso's model 3600 wood burning stove to determine compliance with U.S. EPA emissions regulations.

Tests were conducted by Bill Keen. Present, as an observer for tests, was Bob Ferguson, a representative of Morso. The tests were conducted at the Intertek Testing Services NA Inc. laboratory located at 8431 Murphy Drive, Middleton, Wisconsin. The laboratory elevation is 860 feet above sea level. Tests were conducted to EPA Method 28 and 5G-3 criteria.

I.B. TEST UNIT DESCRIPTION

The Morso 3600 wood burning stove is rectangular in shape. The unit is constructed from cast iron. Two glass and cast iron front doors are hinged on the outside edges while latching in the middle. The doors are latched by closing the left door first and then the right door; with the latch handle located on the right side door. The unit sits on four cast iron legs. The firebox is of single wall construction with firebrick lining. An ash pan is contained inside the unit below a grated bottom. A permanent log retainer is located at the front of the firebox. The lever to control the air setting is located below the ash lip.

I.C. RESULTS

The unit as tested produced a weighted average emissions rate of 5.19 grams/hour and did not exceed any of the emissions rate caps specified in the EPA regulations. The unit thus meets EPA certification requirements for 1990.

I.D. PRETEST INFORMATION

The test unit was received at Intertek Testing Services NA Inc. in Middleton, Wisconsin on August 3, 2001 via Tax Air. The unit was inspected upon receipt and found to be in good condition. The unit was set up following the manufacturer's instructions without difficulty. Following assembly, the unit was placed on the test stand and instrumented with thermocouples in the specified locations. Prior to beginning the emissions tests the unit was operated for a minimum of 10 hours at high-to-medium burn rates. The unit was found to be operating satisfactory during this break-in. The 12 plus hours of pre-burning was conducted August 3-4, 2001. The fuel used for the break-in process is all Red Oak cordwood with Douglas Fir scrap as kindling. The moisture content of the cordwood was 16-20% on the wet basis.

Following the pre-burn break-in process, the unit was allowed to cool. The chimney system and laboratory dilution tunnel was cleaned using standard wire brush chimney cleaning equipment.

On August 5, 2001 the unit was ready for testing.

I.E. REPORT ORGANIZATION

This report includes summaries of all data necessary to determine compliance with the regulations. Raw data, calibration records, intermediate calculations, drawings and specifications and other supporting information are contained in appendices to this report.

II. SUMMARY OF TEST RESULTS

II.A. EMISSIONS

Run Number	Test Date	Burn Rate (kg/hr)	Emission Rate (g/hr)	Adjusted Emission Rate (g/hr)	Heating Efficiency** (% Overall)
1	8/6/01	1.239	3.980	5.728	67.71
2	8/7/01	0.949	1.297	2.257	69.36
3	8/8/01	4.103	6.285	8.369	59.14
4	8/9/01	1.827	5.497	7.489	65.26

**Calculated as specified in CSA B-415

II.B. WEIGHTED AVERAGE CALCULATION

Run Number	Burn Rate	(E) Adjusted Emission Rate g/hr	(OHE)*	Output (BTU/HR)	Prob	(K) Weighting Factor	(KxE)	(KxOHE)
2	0.949	2.257	69.36	11443.23	.3274	0.5672	1.2801	39.34
1	1.239	5.728	67.71	14940.11	.5672	.5513	3.1581	37.33
4	1.827	7.489	65.26	22030.33	.8788	.4278	3.2041	27.92
3	4.103	8.369	59.14	49474.79	.9950	.1212	1.0145	7.17
					Sums:	1.66756	8.6567	111.76

Weighted Average Emissions Rate: 8.6567 ÷ 1.66756 = 5.1913

Weighted Average Overall Heating Efficiency: 111.76 ÷ 1.66756 = 67.02%

*Calculated as specified in CSA B-415

II.C. TEST FACILITY CONDITIONS

Run Number	Room Temperature Before (F)	Room Temperature After (F)	Barometric Pressure Before (in. Hg)	Barometric Pressure After (in. Hg)	Relative Humidity Before (%)	Relative Humidity After (%)	Air Velocity Before (ft/min)	Air Velocity After (ft/min)
1	90	90	29.30	29.30	84	63	0	0
2	90	88	29.28	29.26	72	67	0	0
3	88	90	29.04	29.03	79	61	0	0
4	84	89	29.00	28.96	63	70	0	0

II.D. FUEL QUALITIES

Run Number	Pre-Test Load Loading Weight Wet Basis (lb.)	Pre-Test Load Moisture Content Dry Basis (%)	Coal Bed Weight (lb.)	Test Load Weight Wet Basis (lb.)	Test Load Loading Density (lbs/ft^3)	Test Load Moisture Content Dry Basis (%)	Test Load Piece Length (in.)	Test Load Number of 2x4's	Test Load Number of 4x4's
1	15.49	20.66	3.1	14.87	6.949	21.00	19.00	3	2
2	16.96	20.19	3.4	15.54	7.262	20.42	19.00	3	2
3	15.50	22.04	3.2	15.69	7.332	22.44	19.00	3	2
4	18.31	21.16	3.3	15.61	7.294	20.51	19.00	3	2

.E. DILUTION TUNNEL FLOW RATE MEASUREMENTS AND SAMPLING DATA (5G-3)

	Average Dilution Tunnel Measurements				Sample Data			
Run Number	Burn Time (min)	Velocity (ft/sec)	Volumetric Flow Rate (dscf/min)	Total Temp. (°R)	Sample Volume (dscf) 1	Sample Volume (dscf) 2	Particulate Catch (mg) 1	Particulate Catch (mg) 2
1	270	13.70	141.28	566.50	62.39	63.06	29.5	29.4
2	370	13.29	137.15	565.79	85.59	86.38	12.9	14.2
3	85	16.81	147.24	661.10	19.66	19.70	14.1	13.9
4	193	14.02	136.77	592.38	44.33	44.79	30.0	29.7

I.F. DILUTION TUNNEL DUAL TRAIN PRECISION

Run Number	Sample Ratios Train 1	Sample Ratios Train 2	Total Emissions (grams) Train 1	Total Emissions (grams) Train 2	% Deviation
1	611.45	604.94	18.04	17.79	1.17
2	592.92	587.47	7.65	8.34	7.20
3	636.66	635.26	8.96	8.83	1.37
4	595.49	589.29	17.86	17.50	1.70

Report Date: August 15, 2001 Report #: J20049092, 3005306
Client: Morso Jernstoberi Model: 2110

I.G. GENERAL SUMMARY OF RESULTS

Run Number	Burn Rate (kg/hr)	Average Temperature (F) Combustion	Surface	Change In Surface Temperature (F)	Initial Draft (in. H2O)	Primary Air Setting	Run Time (min)	Average Draft (in. H_2O)
1	1.239	649.50	324.59	-82.60	.065	full closed	270	.060
2	0.949	588.26	305.91	-97.80	.070	full closed	370	.069
3	4.103	1126.10	471.98	-14.60	.096	full open	85	.098
4	1.827	759.00	365.74	-18.00	.072	1-7/8"	193	.076

III. PROCESS DESCRIPTION

III.A. DISCUSSION

RUN #1 (August 6, 2001) The primary air was set at full closed. The test was loaded in 30 seconds. The door was open for 90 seconds and the air control was full open for 5 minutes. Burn time was 270 minutes for a category 2-burn rate of 1.239 kg/hr..

RUN #2 (August 7, 2001) The air control was set at full closed. The test was loaded in 30 seconds. The door was open for 90 seconds. The air control was full open for 3-1/2 minutes and slowly closed till 5 minutes. Burn time was 370 minutes for a category 1-burn rate of 0.949 kg/hr.

RUN #3 (August 8, 2001) The air control was set to full open. The test was loaded in 40 seconds and the door was open for 40 seconds. The air control was not adjusted. Burn time was 85 minutes for a category 4-burn rate of 4.103 kg/hr.

RUN #4 (August 9, 2001). The primary air control was set at 1-7/8" from ash lip. The test was loaded in 38 seconds. The door was open for 90 seconds. The air control was full open for 4-1/2 minutes, then slowly set to 1-7/8" from lip aat 5 minutes. Burn time was 193 minutes for a category 3-burn rate of 1.827 kg/hr.

III.B. UNIT DIMENSIONS

30" high, 29.5" wide and 25" deep.

III.C. AIR SUPPLY SYSTEM

Primary combustion air enters the unit at the rear of the unit and enters the firebox at the front below the grate. Secondary air is channeled up the rear of the firebox and forward in the baffle where it spills out through 4 steps of holes. A single handle controls primary air and secondary air. This handle opens both an oval hole and a parallelogram shaped hole. Combustion products then exit the unit through a six-inch flue collar located centrally at the rear of the stovetop.

III.D. OPERATION DURING TEST

The unit ran well. The first test did not meet the category 1 burn rate and the second test was run with the same settings but closing down the air control sooner in the start up.

III.E. START-UP OPERATION

Each test was started with a clean firebox and the scale zeroed. A fire was started using newspaper and Douglas Fir scraps for kindling. For the low burns, a pre preload test was used to warm up the stove, then the stove was cleaned out and rezeroed. The rest of the tests were then started with two to three pounds of kindling and a warm-up pre-test load of fuel was put in as space allowed. Pretest loads were fired on high until burning well. Stirring was done as required to insure uniform charcoalization. At least one hour prior to reloading the air control was set to the approximate position used during the test. Stirring was limited to less than 1 minute during the last 15 minutes of the pre-test.

IV. SAMPLING SYSTEMS

IV.A. SAMPLING LOCATIONS

Particulate samples are collected from the dilution tunnel at a point 20 feet from the tunnel entrance. The tunnel has two elbows and two mixing baffles in the system ahead of the sampling section. (See Figure 3.) The sampling section is a continuous 13 foot section of 6 inch diameter pipe straight over its entire length. Tunnel velocity pressure is determined by a standard Pitot tube located 60 inches from the beginning of the sampling section. The dry bulb thermocouple is located six inches downstream from the Pitot tube. Tunnel samplers are located 60 inches downstream of the Pitot tube and 36 inches upstream from the end of this section. (See Figure 1.)

Stack gas samples are collected from the steel chimney section 8 feet ± 6 inches above the scale platform. (See Figure 2.)

IV.A.(1) DILUTION TUNNEL

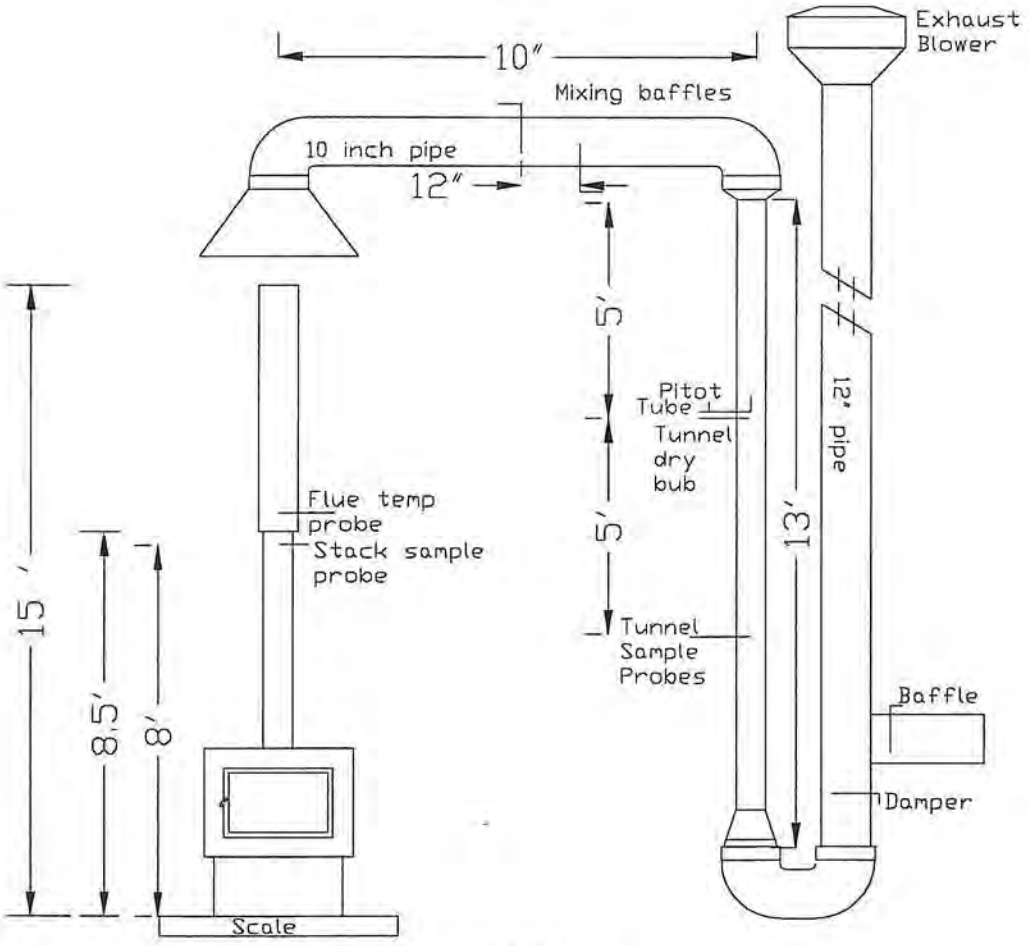
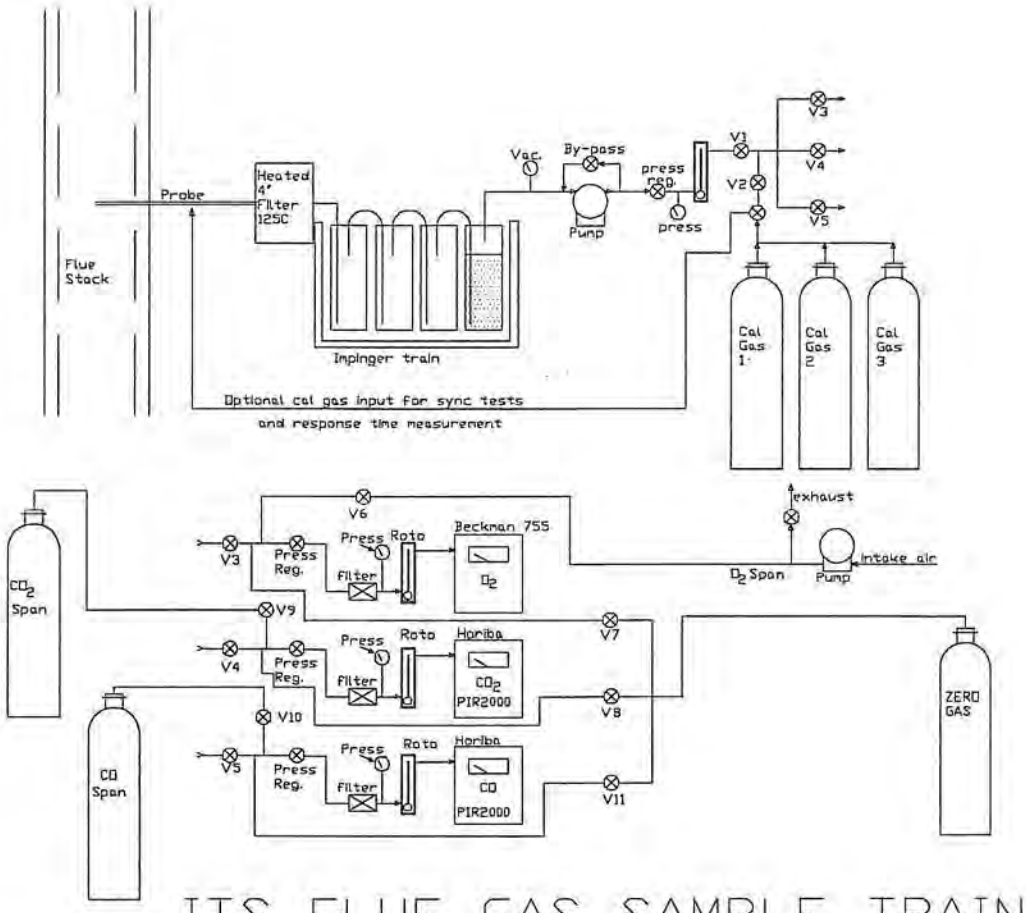


FIGURE 1

IV.B. OPERATIONAL DRAWINGS

IV.B.(1) STACK GAS SAMPLE TRAIN



ITS FLUE GAS SAMPLE TRAIN

FIGURE 2

IV.B.(2). DILUTION TUNNEL SAMPLE SYSTEMS

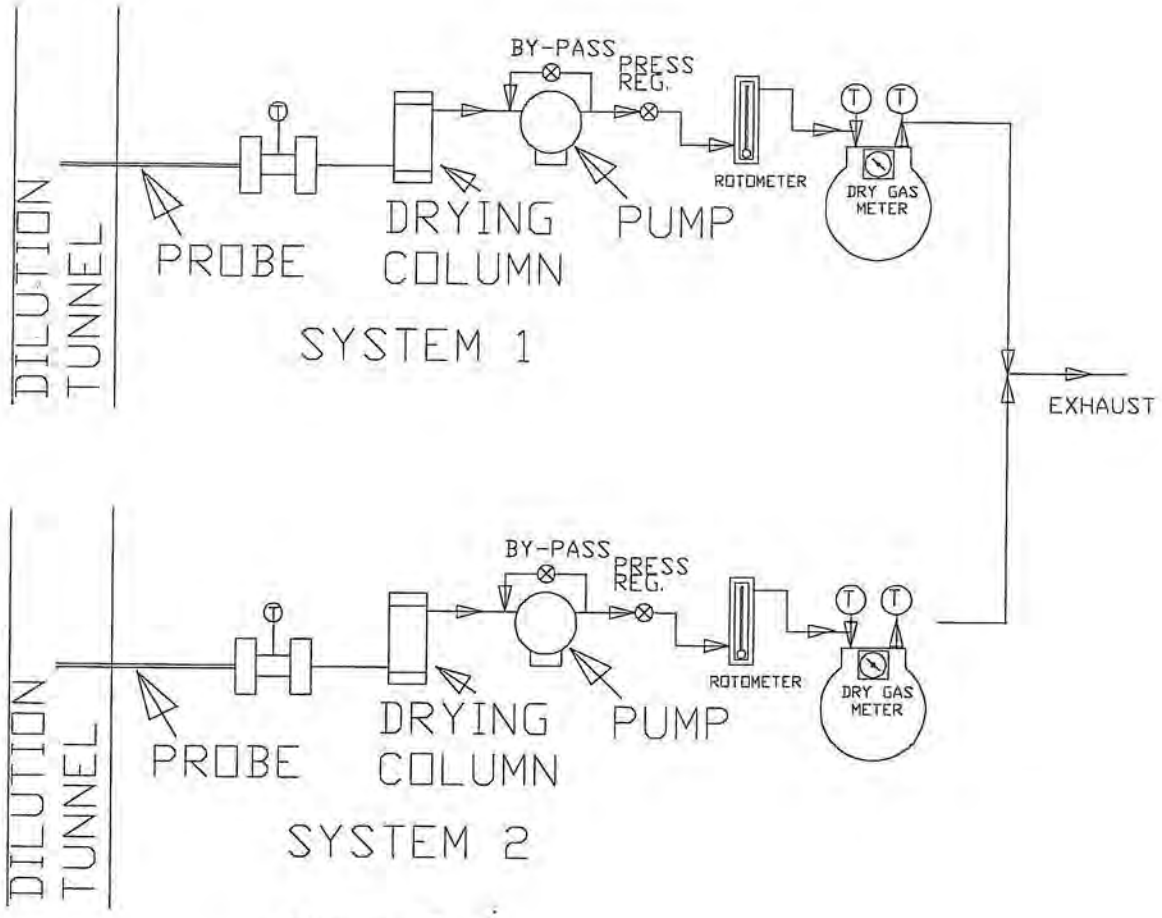


Figure 3

IV.B. EMISSION AND EFFICIENCY EQUIPMENT LIST

ITEM DESCRIPTION	MANUFACTURER	MODEL	SERIAL #
1. CO2 Analyzer (WHI#010)	HORIBA	PIR-2000	607023
2. CO Analyzer (WHI #009)	HORIBA	PIR-2000	6110019
3. O2 Analyzer (WHI #011)	BECKMAN	755	1001926
4. Dry Gas Meter (WHI #012)	Rockwell	T-110	26866
5. Dry Gas Meter (WHI #013)	Rockwell	T-ll0	26873
6. Rotometer (WHI # 015)	Matheson	602 Tube	
7. Rotometer (3) (WHI # 016)	Matheson	603 Tube	
8. Rotometer (2) (WHI # 019)	Matheson	604 Tube	
9. Hot Wire Anemometer (WHI #021)	Alnor	8525	MD 1057
10. Inclined Manometer (WHI #022)	Dwyer	125-AV	
11. Pitot Tube (WHI # 044)			
12. Manometer 0-10" (WHI #024)	Dwyer	400-10	
13. Mercury Barometer (WHI # 142)	Meriam	310EC10WM	184550-X1
14. Draft Indicator (WHI #027)	Dwyer	2000-00	R60825 M29
15. Scale, 1000# Cap./Record.(WHI #025)	Toledo Masstron	ML222	8013
16. Readout for 1000# Scale (WHI #007)	NCI	5780	C800174
17. Scale, 75# Capacity (WHI #006)	NCI	3824-100	762117
18. Readout for 75# Scale (WHI #008)	NCI	5780	G800082
19. Analytical Balance (WHI #028)	OHAUS	G-110	5336
20. Dial-o-gram Balance 2610 g (WHI # 031)	OHAUS	1650	
21. Audit Weights 1 mg-100 g/Class-S (WHI # 029)	Ainsworth	4254-S	39392
22. Diaphragm Pumps (4) (WHI # 032 - 035)	Dayton	ZO24 (1) 2Z866 (3)	
23. Method 5H Glassware (WHI # 036)	Andersen	4" Filter, 4-250 ml Impingers	
24. Gases; Calibration, Zero, Span	Matheson		
25. Regulators for Gases (6) (WHI # 037 - 043)	Matheson	8-(XXXX)	
26. High Accuracy Needle Valves (9)	Matheson		
27. Solenoid Valves (12) (WHI # 045)	Dayton		
28. Switches (Misc.) (WHI # 045)	Dayton		
29. ORSAT Gas Analyzer (WHI # 048)	Fisher	D	
30. Oxygen Bomb Calorimeter (WHI # 047)	Parr	1341	4514
31. Moisture Meter (WHI #049)	Delmhorst	RC-1C	14356
32. Humidity Chamber (WHI # 050)	Lab Built		
33. Dilution Tunnel (WHI # 046)	Lab Built		
34. Spirometer (WHI # 51)	Lab Built		
35. Data Acquisition System (WHI # 052)	Lab Built		
36. Drying Oven (WHI # 002)	Blue-M	SW-11TA-1	SW-291
37. Filter Holders, 47-mm (8) (WHI # 053)	Nalgene		
38. Type-K Meter (WHI #054)	Omega	199	21662
39. Digital Voltmeter (WHI # 055)	Newport	2004-3	6090022-3
40. Type K Thermocouple Wire 24 Ga.	Gordon	Special Limits of Error	
41. Type K T/C Plugs	Gordon	K-901/900	
42. Dry Gas Meter (WHI #014)	Rockwell	T-110	27002
43. Audit Weights; 5#, 10# (WHI # 160)	Rice Lake Weighing System		Class-F
44. Sling Psychrometer (WHI # 126)	Taylor		
45. Chart Recorder (WHI # 056)	Cole-Palmer	2030-0000	221063
46. Infrared Pyrometer (WHI #102)	Omega	OS-2000A	A4048T
47. Class C Weights 1-500 g (WHI # 161)	Ohaus		
48. Bomb Calorimeter Thermometer (WHI # 162)	Parr	1603	3K9347
49. Microtector Gauge (WHI # 103)	Dwyer	1430	
50. Bubble flow meter (WHI # 415)	Humonics	650	570192
51. Soxhlet extractor (WHI # 413)	Fisher Scientific		
52. ESS Unit (WHI # 416)	Omni		
53. Unimantle (WHI # 413)			
54. Magnehelic (WHI #027)			

Prepared January 1988 by Rick Curkeet / Rev. May1997 by Rick Armstrong

V. SAMPLING METHODS

V.A. PARTICULATE SAMPLING

Particulates were sampled in strict accordance with EPA Method 5G-3. This method uses two identical sampling systems with Gelman A/E 61631 binder free, 47-mm diameter filters. The dryers used in the sample systems are filled with "Drierite" before each test run.

V.B. EFFICIENCY

Efficiencies reported were based on Method CSA-B415 (calculation). Stack gas analysis for oxygen, carbon dioxide and carbon monoxide was performed in accordance with EPA Method 5H.

VI. QUALITY ASSURANCE

VI.A. INSTRUMENT CALIBRATION

VI.A.(1). DRY GAS METERS

At the conclusion of each test program the dry gas meters are checked against our standard dry gas meter. Three runs are made on each dry gas meter used during the test program. The average calibration factors obtained are then compared with the six-month calibration factor and, if within 5%, the six-month factor is used to calculate standard volumes. Results of this calibration are contained in Appendix D.

An integral part of the post test calibration procedure is a leak check of the pressure side by plugging the system exhaust and pressurizing the system to 10" W.C. The system is judged to be leak free if it retains the pressure for at least 10 minutes.

The standard dry gas meter is calibrated every 6 months using a Spirometer designed by the EPA Emissions Measurement Branch. The process involves sampling the train operation for 1 cubic foot of volume. With readings made to .001 ft^3, the resolution is .1%, giving an accuracy higher than the ±2% required by the standard.

VI.A.(2). STACK SAMPLE ROTAMETER

The stack sample rotometer is checked by running three tests at each flow rate used during the test program. The flow rate is checked by running the rotometer in series with one of the dry gas meters for 10 minutes with the rotometer at a constant setting. The dry gas meter volume measured is then corrected to standard temperature and pressure conditions. The flow rate determined is then used to calculate actual sampled volumes.

VI.A.(3). GAS ANALYZERS

The continuous analyzers are zeroed and spanned before each test with appropriate gases. A mid-scale multi-component calibration gas is then analyzed (values are recorded). At the conclusion of a test, the instruments are checked again with zero, span and calibration gases (values are recorded only). The drift in each meter is then calculated and must not exceed 5% of the scale used for the test.

At the conclusion of each unit test program, a five-point calibration check is made. This calibration check must meet accuracy requirements of the applicable standards. Consistent deviations between analyzer readings and calibration gas concentrations are used to correct data before computer processing. Data is also corrected for interferences as prescribed by the instrument manufacturers instructions. Calibration gases are checked by ORSAT analysis when received to verify suppliers analysis.

VI.B. TEST METHOD PROCEDURES

VI.B.(1). LEAK CHECK PROCEDURES

Before and after each test, each sample train is tested for leaks. Leakage rates are measured and must not exceed 0.02 CFM or 4% of the sampling rate. Leak checks are performed checking the entire sampling train, not just the dry gas meters. Pre-test and post-test leak checks are conducted with a vacuum of 10 inches of mercury. Vacuum is monitored during each test and the highest vacuum reached is then used for the post test vacuum value. If leakage limits are not met, the test run is rejected. During, these tests the vacuum was typically less than 2 inches of mercury. Thus, leakage rates reported are expected to be much higher than actual leakage during the tests.

VI.B.(2). TUNNEL VELOCITY/FLOW MEASUREMENT

The tunnel velocity is calculated from a center point pitot tube signal multiplied by an adjustment factor. This factor is determined by a traverse of the tunnel as prescribed in EPA Method 1. Final tunnel velocities and flow rates are calculated from EPA Method 2, Equation 6.9 and 6.10. (Tunnel cross sectional area is the average from both lines of traverse.)

Pitot tubes are cleaned before each test and leak checks are conducted after each test.

VI.B.(3). PM SAMPLING PROPORTIONALITY (5G-3)

Proportionality was calculated in accordance with EPA Method 5G-3. The data and results are included in Appendix C.

All tests were conducted, analyzed, and reported on by:

Bill Keen, Engineering Technician

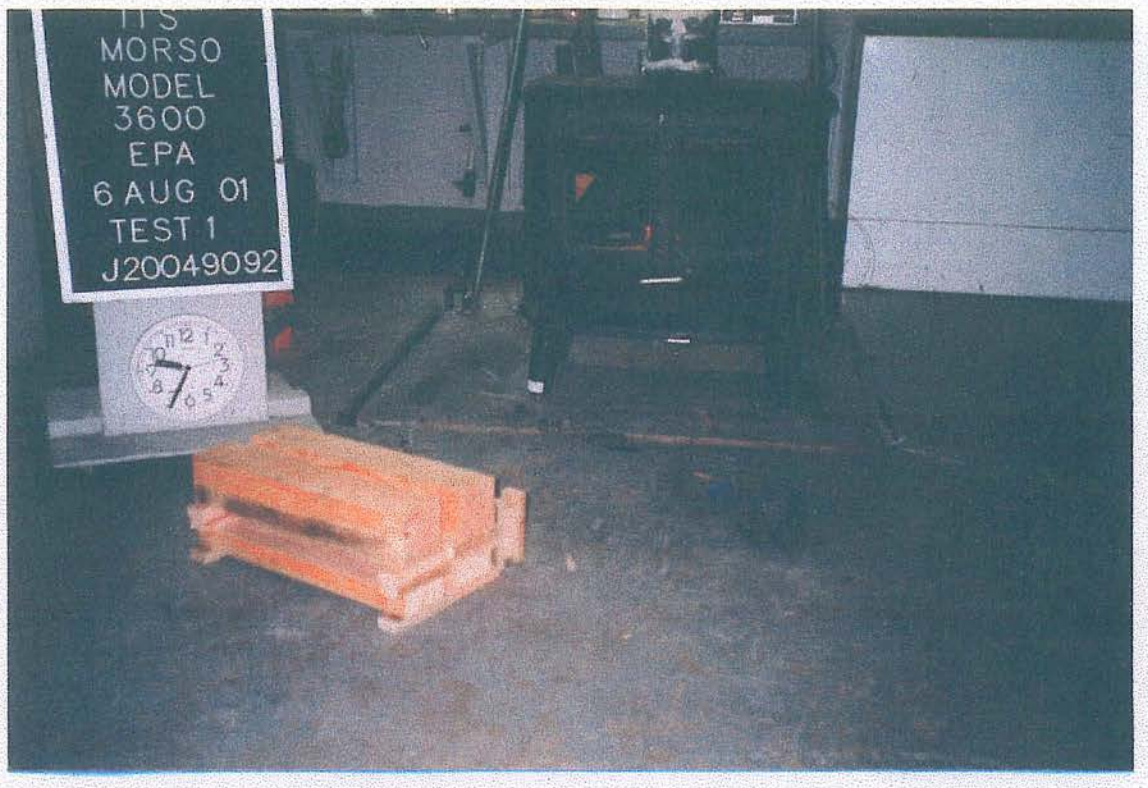
Reviewed By:

Edwin Hodgson, Project Manager

Richard Armstrong, Engineering Technician

Report Date: August 15, 2001
Client: Morso

Report No. J20049092-231, 3005306
Model: 3600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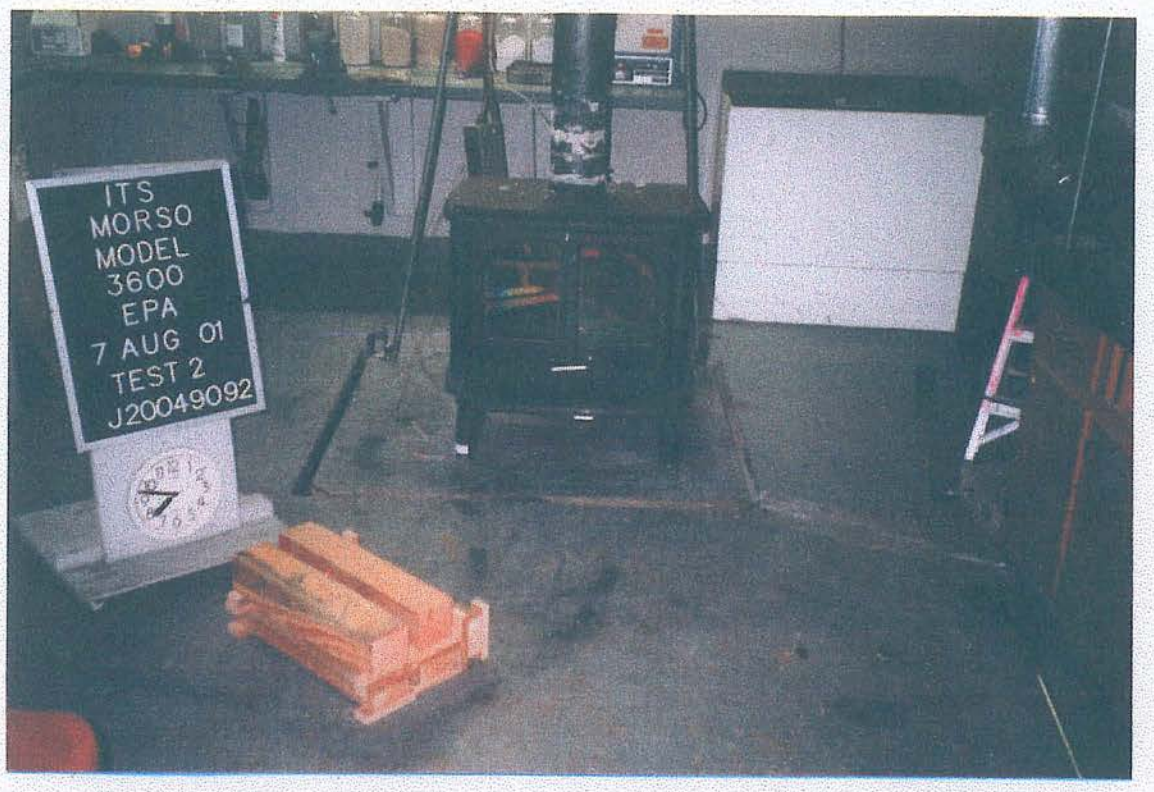
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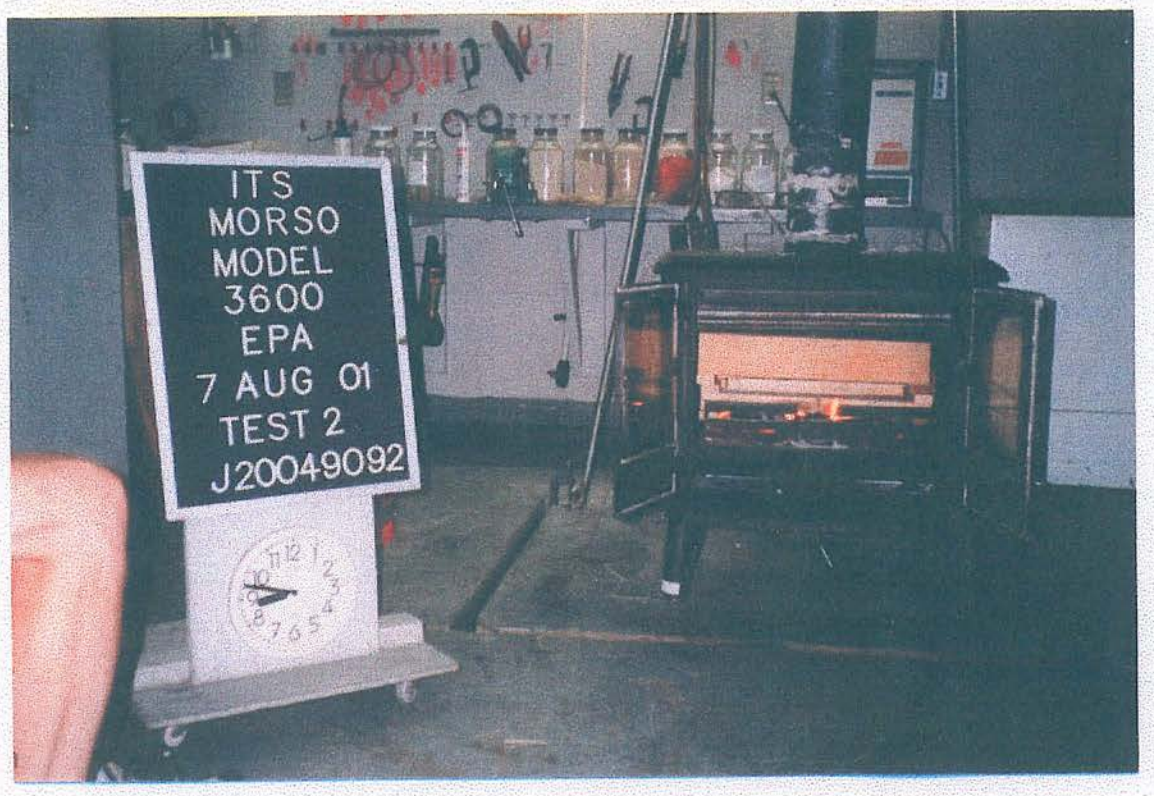
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APPENDIX A

Intertek Testing Services

SFBA EPA ADJUSTED EMISSION RESULTS

Manufacturer:	Morso			RESULTS	
Model:	3600				
Date:	8/6/01		AVERAGE ADJUSTED EMISSION F		5.728
Run:	1				
Project #:	J20049092		Burn Rate (Dry kg/hr):		1.239
Test Duration:	270				
(minutes)					
	PRESSURE FACTOR:	0.97928	BAROMETRIC PRESSURE		
				Average:	29.3
TEMPERATURE FACTORS				Start:	29.3
	DGM #1:	0.96627		End:	29.3
	DGM #2:	0.96881			
			DRY GAS METER VALUES		
VOLUMES SAMPLED			DGM #1	Final:	304.733
	DGM #1:	62.38804		Initial:	240.132
	DGM #2:	63.05914			
			DGM #2	Final:	650.944
TOTAL TUNNEL VOLUME (scf):		38146.929		Initial:	586.482
SAMPLE RATIOS			TEMPERATURES (DEG. RANKIN)		
	Sample Train 1:	611.446		DGM #1:	546.429
	Sample Train 2:	604.939		DGM #2:	545.000
TOTAL EMISSIONS			CALIBRATION FACTORS		
Sample Train 1 (g):		18.0377		DGM #1:	1.0206
Sample Train 2 (g):		17.7852		DGM #2:	1.0311
EMISSION RATES			TUNNEL FLOW RATE:		141.285
Sample Train 1 (g/hr):		4.0084			
Sample Train 2 (g/hr):		3.9523	PARTICULATE CATCH (mg)		
				Sample Train 1:	29.5
ADJUSTED EMISSION RATES				Sample Train 2:	29.4
Sample Train 1 (g/hr):		5.7615			
Sample Train 2 (g/hr):		5.6945			
	DEVIATION:	1.17%			

Intertek Testing Services

SFBA EPA ADJUSTED EMISSION RESULTS

Manufacturer:	Morso
Model:	3600
Date:	8/8/01
Run:	2
Project #:	J20049092
Test Duration: (minutes)	370

PRESSURE FACTOR:	0.97828

TEMPERATURE FACTORS

DGM #1:	0.96804
DGM #2:	0.96862

VOLUMES SAMPLED

DGM #1:	85.58870
DGM #2:	86.38268
TOTAL TUNNEL VOLUME (scf):	50747.168

SAMPLE RATIOS

Sample Train 1:	592.919
Sample Train 2:	587.469

TOTAL EMISSIONS

Sample Train 1 (g):	7.6487
Sample Train 2 (g):	8.3421

EMISSION RATES

Sample Train 1 (g/hr):	1.2403
Sample Train 2 (g/hr):	1.3528

ADJUSTED EMISSION RATES

Sample Train 1 (g/hr):	2.1762
Sample Train 2 (g/hr):	2.3388
DEVIATION:	7.20%

RESULTS

AVERAGE ADJUSTED EMISSION RATE:	2.257
Burn Rate (Dry kg/hr):	0.949

BAROMETRIC PRESSURE

Average:	29.27
Start:	29.28
End:	29.26

DRY GAS METER VALUES

DGM #1	Final:	393.585
	Initial:	305.031
DGM #2	Final:	739.363
	Initial:	650.951

TEMPERATURES (DEG. RANKIN)

DGM #1:	545.434
DGM #2:	545.105

CALIBRATION FACTORS

DGM #1:	1.0206
DGM #2:	1.0311

TUNNEL FLOW RATE:	137.155

PARTICULATE CATCH (mg)

Sample Train 1:	12.9
Sample Train 2:	14.2

Intertek Testing Services

SFBA EPA ADJUSTED EMISSION RESULTS

Manufacturer:	MORSO			RESULTS		
Model:	3600		AVERAGE ADJUSTED EMISSION F			8.369
Date:	8/8/01					
Run:	3		Burn Rate (Dry kg/hr):			4.103
Project #:	0					
Test Duration: (minutes)	85					
PRESSURE FACTOR:		0.97042	BAROMETRIC PRESSURE			
					Average:	29.035
TEMPERATURE FACTORS					Start:	29.04
DGM #1:		0.97184			End:	29.03
DGM #2:		0.97489				
			DRY GAS METER VALUES			
VOLUMES SAMPLED				DGM #1	Final:	414.044
DGM #1:		19.65852			Initial:	393.620
DGM #2:		19.70168				
				DGM #2	Final:	759.571
TOTAL TUNNEL VOLUME (scf):		12515.759			Initial:	739.374
SAMPLE RATIOS			TEMPERATURES (DEG. RANKIN)			
Sample Train 1:		636.658			DGM #1:	543.300
Sample Train 2:		635.264			DGM #2:	541.600
TOTAL EMISSIONS			CALIBRATION FACTORS			
Sample Train 1 (g):		8.9769			DGM #1:	1.0206
Sample Train 2 (g):		8.8302			DGM #2:	1.0311
EMISSION RATES			TUNNEL FLOW RATE:			147.244
Sample Train 1 (g/hr):		6.3366				
Sample Train 2 (g/hr):		6.2331	PARTICULATE CATCH (mg)			
					Sample Train 1:	14.1
ADJUSTED EMISSION RATES					Sample Train 2:	13.9
Sample Train 1 (g/hr):		8.4258				
Sample Train 2 (g/hr):		8.3114				
DEVIATION:		1.37%				

Intertek Testing Services

SFBA EPA ADJUSTED EMISSION RESULTS

Manufacturer:	Morso			RESULTS	
Model:	3600		AVERAGE ADJUSTED EMISSION F		7.489
Date:	8/9/01				
Run:	4		Burn Rate (Dry kg/hr):		1.827
Project #:	J20049092				
Test Duration: (minutes)	193				
	PRESSURE FACTOR:	0.96858	BAROMETRIC PRESSURE		
				Average:	28.98
TEMPERATURE FACTORS				Start:	29
	DGM #1:	0.96987		End:	28.96
	DGM #2:	0.97093			
			DRY GAS METER VALUES		
VOLUMES SAMPLED			DGM #1	Final:	460.600
	DGM #1:	44.32674		Initial:	414.366
	DGM #2:	44.79301			
			DGM #2	Final:	805.902
TOTAL TUNNEL VOLUME (scf):		26396.089		Initial:	759.708
SAMPLE RATIOS			TEMPERATURES (DEG. RANKIN)		
	Sample Train 1:	595.489		DGM #1:	544.405
	Sample Train 2:	589.290		DGM #2:	543.810
TOTAL EMISSIONS			CALIBRATION FACTORS		
Sample Train 1 (g):		17.8647		DGM #1:	1.0206
Sample Train 2 (g):		17.5019		DGM #2:	1.0311
EMISSION RATES			TUNNEL FLOW RATE:		136.767
Sample Train 1 (g/hr):		5.5538			
Sample Train 2 (g/hr):		5.4410	PARTICULATE CATCH (mg)		
				Sample Train 1:	30
ADJUSTED EMISSION RATES				Sample Train 2:	29.7
Sample Train 1 (g/hr):		7.5523			
Sample Train 2 (g/hr):		7.4248			
	DEVIATION:	1.70%			

ITS Intertek Testing Services

Manufacturer Morso Model 3600 Wood Stove Date 8/13/07

Job # J20049092 Tech MC

Emissions Testing Initial Stove Check Out

Date received: 8/13/01 Carrier: Tax Air

Shipping damage? X No ____ Yes Describe damage ____

If damaged, repairable? ____ No ____ Yes

Repairs affected by: ____ Date: ____

Client notified about
irreparable damage by: ____ Date: ____

Disposition: ____

Safety Certified by: ____ Safety Control# ____

Overall Unit Dimensions: High 30" Wide 29 1/2 Deep 25"

Comments:

Initialed: MC

ITS Intertek Testing Services

Manufacturer Morso Model 3600 Wood Stove Date 8/6/01

Job # J20049092 Tech MC

EMISSIONS TESTING UNIT PREPARATION

Unit description (check all that apply)

X Stove	X Top Vent	___ Manual Draft
___ Insert	___ Rear Vent	___ Bimetal Spring
___ Catalytic	X Grate	___ Remote Thermostat
X Non-catalytic	X Ashpan	___ Blower or Fans
___ Other:		

Unit received with all parts: X Yes ___ No
Manual: ___ Yes X No
Drawings: ___ Yes X No
Specifications: ___ Yes X No
Materials of construction: Cast Iron
Air introduction: controlled at rear
Control mechanism: handle in front

Unit net weight with all components: 433.5 lbs. 196.7 Kg.
Unit fire box volume: 2.14 Ft^3 (attach fire box volume calculations and drawings)
Ideal Load Weight: 14.98 lbs. (Volume x 7)
Load Weight Range: (±10% of ideal weight) 13.48 lbs. to 16.48 lbs.
Ideal piece length specification: 20 inches. (5/6 of longest fire box dimension)
Thermocouples attached: 8/3/01 Attached by: MC (attach T/C map)

Unit conditioned prior to test

X 10 hours at medium burn rate (non-catalytic) (attach burn log)

___ 50 hours at medium burn rate (attach burn log)

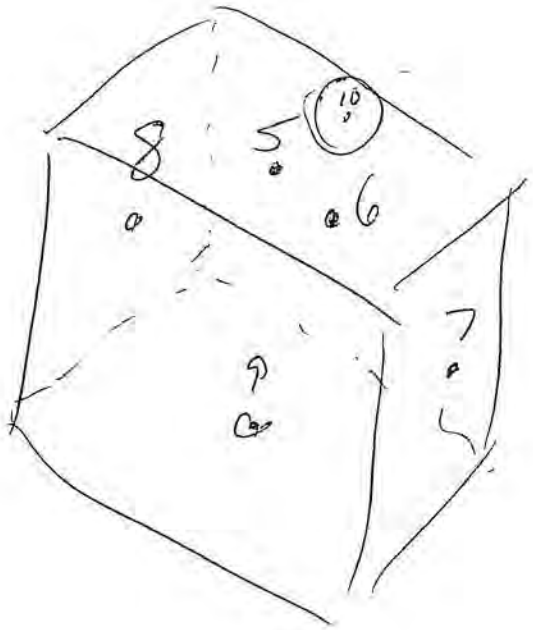
Date started: 8/3/01 Date completed: 8/4/01
Catalyst manufacturer:
Serial number: N/A Dimensions: ___ Cell size: ___ cells/in.^{2}
Unit ready for testing (date): 8/6/01 Initialed:

Manufacturer Morso Model 3600 Wood Stove Date 8/6/01

Job # J20049092 Tech

Thermocouple Location

Thermocouples are placed centrally on the top, back, right and left sides and the bottom and numbered as shown below.



TC#	LOCATION
5	UNIT TOP
6	UNIT BACK
7	UNIT RIGHT
8	UNIT LEFT
9	UNIT BOTTOM

ITS Intertek Testing Services

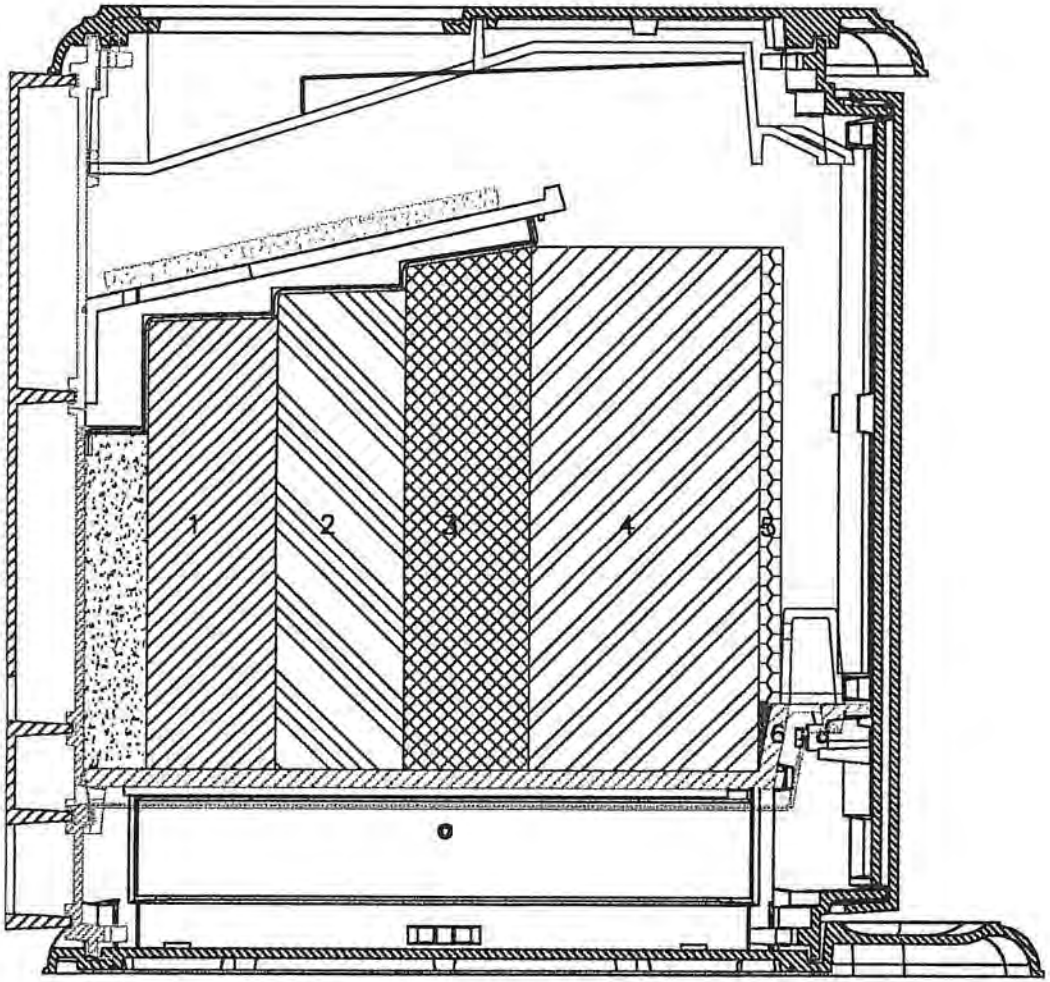
Manufacturer Morso Model 3600 Wood Stove Date 8/13/01

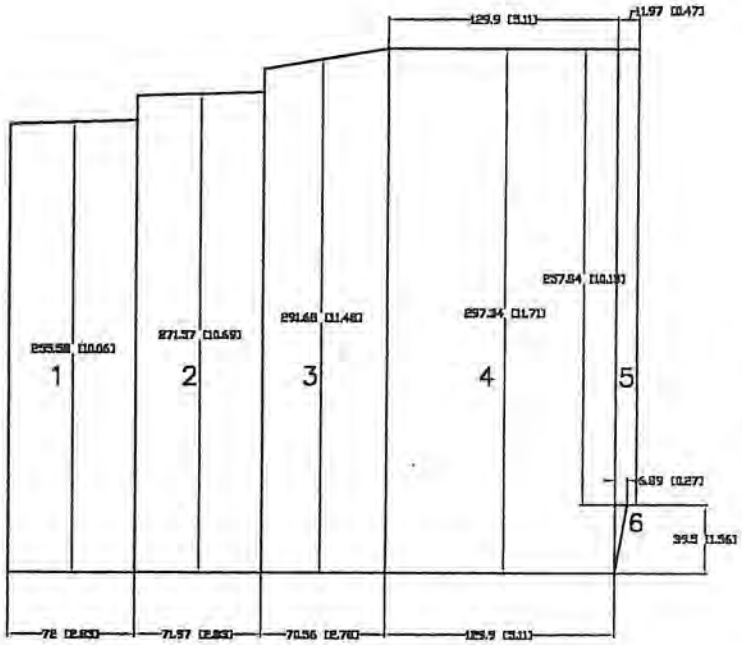
Job # J20049092 Tech

Measurements By: Checked By:

FIRE BOX VOLUME CALCULATION

See computer drawings

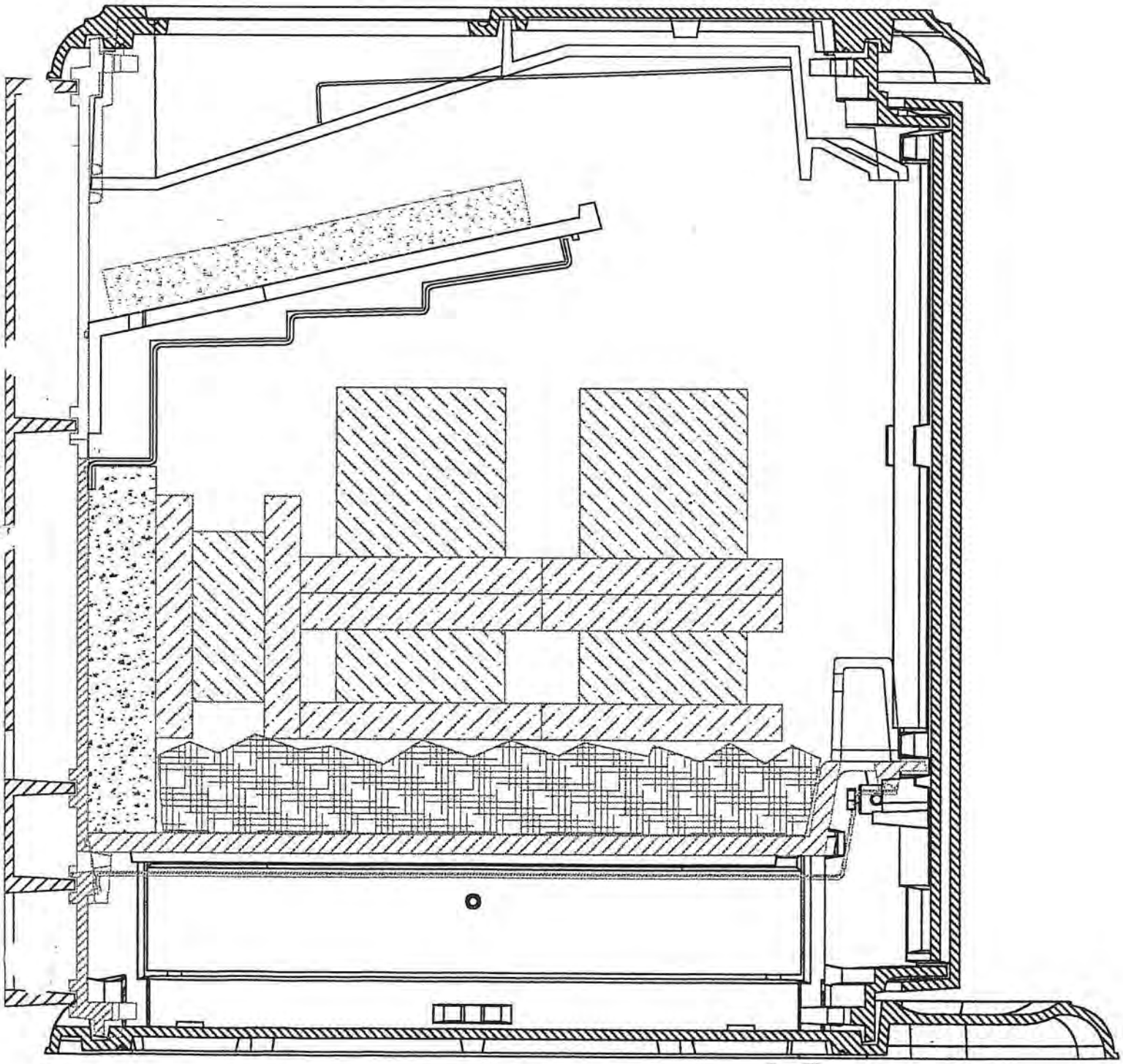




1. 10.06 X 2.83 X 24.00 = 683.28
2. 10.69 X 2.83 X 24.00 = 726.06
3. 11.48 X 2.78 X 24.00 = 765.95
4. 11.71 X 5.11 X 24.00 = 1405.20
5. 10.15 X 0.47 X 24.00 = 114.49
6. .5 X 1.56 X 0.27 X 24.00 = 5.05

Total
= 3700.03 cubic inches
3700.03 / 1728 = 2.141 cubic feet

PAGE — OF —



Manufacturer Morso Model 3600 Date 8/6/01

Job # J20049092 Run 1 Tech WH

PRETEST DILUTION TUNNEL TRAVERSE RUN

Barometric pressure (P_{bar}) 29.30 (inches Hg.) Static pressure (P_g) -.145 (inches w.c.)
Inside diameter: Port A 6in. Port B 6in. Tunnel cross sectional area: 0.1963Ft²
Pitot tube type: Standard

Traverse Point	Position (inches)	Velocity Head Δ_p (inches H_2O)	Tunnel Temperature (°F)	$\sqrt{\Delta p}$
A-Centroid	3.00	.041	124	.2025
B-Centroid	3.00	.041	116	.2025
A-1	0.40	.040	122	.2008
A-2	1.50	.041	124	.2025
A-3	4.50	.041	124	.2025
A-4	5.60	.037	122	.1924
B-1	0.40	.039	117	.1975
B-2	1.50	.041	116	.2025
B-3	4.50	.041	116	.2025
B-4	5.60	.034	118	.1849
		AVERAGE	119.9	.1989

Adjustment factor application

$$V_s = K_p C_p F_p \left(\sqrt{\Delta_p}\right) AVG \sqrt{\frac{T_s}{P_s M_s}} \qquad V_s = K_p C_p \left(\sqrt{\Delta_p}\right) avg. \sqrt{\frac{T_s}{P_s M_s}}$$

Pitot correction .145

Where,
C_p = Pitot tube coefficient = 0.99 for standard pitot
Δ_p = manometer reading (inches H_2O)
T_s = average absolute dilution tunnel temperature (°F + 460)

$$F_p = \frac{\left(\sqrt{\Delta_p}\right) avg}{\left(\sqrt{\Delta_p}\right) centroid}$$

P_s = absolute dilution tunnel gas pressure or Pbar + P_g
P_g = static pressure

$$\frac{inches H_2O}{13.6}$$

M_s = 28.56, wet molecular weight of stack gas (alternatively, it may be measured)
K_p = 85.49 Pitot tube constant, (conversion factor for English units)

Adjustment factor for alternative Pitot tube placement:

$\left(\sqrt{\Delta_p}\right) avg.$ = Average of the square roots of the velocity heads (Δ_p) measured at each traverse point.

$\left(\sqrt{\Delta_p}\right) centroid$ = Average of the square roots of the velocity heads measured at the tunnel centroid (inches of H_2O)

ITS Intertek Testing Services

Manufacturer Morso Model 3600 Date 8/16/01

Job # J20049092 Run 1 Tech MC

Pre/Post Checks

Moisture Meter Calibration Check: Time: 6:30 | X: ✓ | Y: ✓ | 12: ✓ | 22: ✓

	Pre-Test	Post-Test
Facility Conditions:		
Air Velocity	0 fpm	0 fpm
Smoke Capture Check	✓	✓
Wood Heater Conditions:		
Date Wood Heater Stack Cleaned	8/14/01	
Date Dilution Tunnel cleaned	8/14/01	
Induced Draft Check	0	0
Tunnel Velocity	.040	.040
Flow Rate 140-cfm ±10%		141.285
Pitot Leak Check:		
Side A	✓	✓
Side B	✓	✓
Temperature System:		
Ambient (65°- 90°F)		90 °F
Wood Heater Surface (±125°F)		82.6 °F
Proportional Checks:		
CO Analyzer Drift Check		✓
CO_2 Analyzer Check		✓
O_2 Analyzer Check		✓
Thermocouple check		✓

Sampling Train ID Numbers:	Train 1	Train 2
Probe	1	2
Filter Front	9	11
Filter Back	10	12
Filter Thermocouple	19	22
Filter 5G-3 (<90°F)	✓	✓

Thermocouple Identification Number

Flue....1	Room....2	Dilution Tunnel Dry Bulb....3
Dilution Tunnel Wet Bulb....4	Unit Top....5	Unit Back....6
Unit Right Side....7	Unit Left Side....8	Unit Bottom....9
Catalyst/Combustion Chamber....10		

Manufacturer Morso Model 3600 Date 8/6/01

Job # J20049092 Run 1 Tech [illegible]

Pre-Test Scale Audit

Scale Type	Audit Weight	Measured Weight
Platform	10 lbs., Class F	10.0 lbs.
Wood	10 lbs., Class F	10.00 lbs.
Analytical	100 Grams mg, Class S	Grams 100.1 mg.

LIMITS OF WEIGHT RANGES

ANALYTICAL SCALE: ..... 50%-150% of dry filter weight, ± 0.1 mg
PLATFORM SCALE ..... 20%-80% of ideal test load weight, ± 0.1 lbs. or 1%
WOOD SCALE ..... 20%-80% of ideal test load weight, ± 0.1 lbs. or 1%

Manufacturer Morso Model 3600 Date 8/16/01

Job # J20049092 Run 1 Tech [illegible]

SAMPLING EQUIPMENT CHECK OUT

Leakage Checks Tunnel Samplers

	SYSTEM 1		SYSTEM 2	
Unplugged Flow Rate = .25cfm	Pre-Test	Post-Test	Pre-Test	Post-Test
Vacuum (inches Hg.)	10"	10"	10"	10"
Final 1minute DGM (ft^3)	240.132	304.741	586.482	650.948
Initial 1minute DGM (ft^3)	240.132	304.741	586.482	650.948
Change (C) (ft^3)	0	0	0	0
Allowable leakage .04 x Sample rate or .02cfm	0.0100	0.0100	0.0100	0.0100
Check OK	✓	✓	✓	✓

Leakage Checks Flue Gas Sampler

Plugged Probe	Pre Test	Post Test
Vacuum (inches Hg.)	10"	10"
Rotometer Reading (mm)	0	0
Flow Rate (CFM)	0	0
Allowable (.04 x Sample Rate)		
Check OK	✓	✓

Manufacturer Morso Model 3600 Date 8/6/11

Job # J20049092 Run 1 Tech [illegible]

CONTINUOUS ANALYZERS

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
CO	00.00	00.00	9.96	9.96	00.96	.999
CO_2	00.00	00.00	24.65	24.65	9.65	9.99
O_2	00.00	00.00	20.93	20.93	10.27	10.2
	Actual	Should Be	Actual	Should Be	Actual	Should Be

Post Test (Record Only)

	Zero	Span	Cal.	Zero Drift	Span Drift	Cal. Drift	OK?	Not OK*
CO	00.00	10.05	00.96	-0-	.09	-0-	✓	
CO_2	00.00	24.80	9.70	-0-	.15	.05	✓	
O_2	00.01	20.83	10.27	.01	.10	-0-	✓	

* Greater than ± 5% of the range used.

Manufacturer Morso Model 3600 Date 8/6/01

Job # J20049092 Run 1 Tech [illegible]

TEST DATA LOG

RAW DRY GAS METER READINGS

	System 1	System 2
Final (ft^3)	304.733	650.944
Initial (ft^3)	240.132	586.252

AMBIENT CONDITIONS

	Start	End
Barometer. (inches Hg)	29.30	29.30
Wet Bulb (°F)		
Dry Bulb (°F)	74	79
Humidity (%)	84	63

Manufacturer Morso Model 3600 Date 8/3/01

Job # J20049092 Run 1 Tech [illegible]

DILUTION TUNNEL PARTICULATE SAMPLER DATA

FILTER TYPE: Gelman 47mm A/E

Samples in Desecrator. Date: 8/6/01 Time: 14:36

	SYSTEM 1		SYSTEM 2	
	Probe and Front Half Housing # 1	Filter Numbers 9, 10	Probe and Front Half Housing # 2	Filter Numbers 11, 12
Post Test Weight:	91.4401 grams	.2463 grams	91.6245 grams	.2453 grams
Pre Test Weight:	91.4395 grams	.2174 grams	91.6242 grams	.2162 Grams
Gain:	.0006 grams	.0289 grams	.0003 grams	.0291 Grams
	a1	b1	a2	b2

Total Gain: a1 + b1 = 29.5 m grams a2 + b2 = 29.4 m grams

Pre-test Weight Record		SYSTEM 1			SYSTEM 2				
Date	Time	Probe & Housing Number	Front Filter Number	Back Filter Number	Probe & Housing Number	Front Filter Number	Back Filter Number	TEMP	HUMID
		1	9	10	2	11	12	°F	%
8/3/01	1515	91.4395	.1145	.1090	91.6247	.1145	.1018	78	49
8/4/01	10:00	91.4395	.1145	.1032	91.6246	.1144	.1020	76	47
8/5/01	9:20	91.4395	.1144	.1031	91.6243	.1144	.1018	76	48
8/6/01	6:10	91.4395	.1144	.1030	91.6242	.1144	.1018	76	49
		Total	2174		Total	.2162			

Pre-test Weight Record		SYSTEM 1		SYSTEM 2			
Date	Time	Probe & Housing Number	Combined Filter Weight Number	Probe & Housing Number	Combined Filter Weight Number	TEMP	HUMID
		1	9, 10	2	11, 12	°F	%
8/6/01	14:36	91.4411	.2482	91.6279	.2482	85	46
8/7/01	5:45	91.4407	.2470	91.6245	.2453	75	48
8/8/01	6:58	91.4401	.2465	91.6245	.2453	74	45
8/9/01	7:11	91.4401	.2463	91.6245	.2453	73	48

Manufacturer Morso Model 3600 Date 8/6/10

Job # J20049092 Run 1 Tech [illegible]

FUEL DATA

FUEL DESCRIPTION: 64

PRE-TEST LOAD

Kindling weight: 2.7 lbs. Consisting of: Scrap and paper Fire lit Time 6:55

Pre-test load weight: 15.49 lbs. Consisting of: 2X4X 10, 19 inches Time loaded: 8:42

Pre-test moisture content: Uncorrected: 19.33 % Corrected Dry: 20.66 % Wet: 17.12 %

Test Air Control Settings: full closed Time: 8:59

Test Unit Fan Settings: Time:

TEST LOAD

	Lower Limit	Ideal	Upper Limit
Test Load Weight:	13.48 Lbs.	14.98 lbs.	16.48 Lbs.

Fire Box Volume:	2.14 Ft.³	Ideal Length:	20.0 Inches
Load Volume:	.4946 Ft.³	Loading Density:	6.949 lbs/ft³
Number of Spacers	16 ¾x1½x5	Load Density:	30.062 lbs/ft³

Piece Size	Weight	Meter Moisture Content (% dry)*		
2 x 4 x 19 in.	2.30 lbs.	22.5 %	21.3 %	18.1 %
2 x 4 x 19 in.	2.29 lbs.	19.2 %	21.5 %	18.8 %
2 x 4 x 19 in.	2.12 lbs.	20.3 %	20.0 %	20.1 %
4 x 4 x 19 in.	4.28 lbs.	18.3 %	19.5 %	20.1 %
4 x 4 x 19 in.	3.88 lbs.	18.8 %	18.0 %	18.1 %
x x 1 in.	lbs.	%	%	%
x x in.	lbs.	%	%	%

*Uncorrected range = 17.9% to 23.1%

TEST LOAD WEIGHT: 14.87 lbs. **DRY WEIGHT:** 5.57 kg.

AVERAGE MOISTURE CONTENT:

(DRY) 19.64% CORRECTED TO TWO PIN: (DRY) 21.00 % (WET) 17.36 %

COAL BED RANGE: 3.0 lbs. to 3.7 lbs. (20% to 25% of test load)

TEST CHARGE:

Time loaded: 10:02 Coal bed weight: 3.1 lbs. Coal bed weight = 20.8 % of test load weight

CHARCOALIZATION: good 10-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|pr

Manufacturer Morso Model 3600 Date 8/6/01

Job # J20049092 Run 1 Tech [illegible]

COMMENTS

6:55 2.7 lbs kindling fire started

7:00 12.9 lbs of kindling added

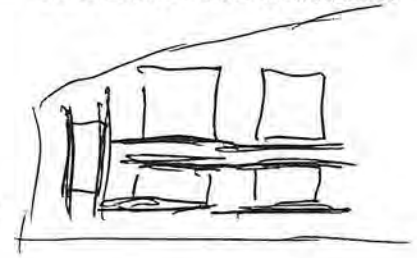
8:35 Stove cleaned out, scale rezeroed

8:37 6.9 lbs of kindling added

8:42 7.77 lbs of preload added

8:50 Remainder of preload added

TEST LOAD CONFIGURATION



Manufacturer Morso Model 3600 Date 8/16/01

Job # J20049092 Run 1 Tech [illegible]

Air control full closed

SWITCH NUMBER			1	2	3	4	5	6	7	8	9	10				
READING #	REAL TIME	ELAPSED TIME	WEIGHT REMAINING	FLUE GAS TEMP	ROOM TEMP	TUNNEL DRY BULB	TUNNEL WET BULB	UNIT TOP	UNIT BACK	UNIT RIGHT SIDE	UNIT LEFT SIDE	UNIT BOTTOM	CATALYST DOWNSTREAM	TUNNEL VELOCITY	DRAFT	SMOKE
0	9:00	0	9.00	771	90	225	81	677	196	335	348	488	1227		.078	
1		10	7.50	507	90	137	80	646	205	357	358	460	963	.040	.084	C
2		20	6.30	485	90	128	81	624	215	348	341	465	967	.041	.081	C
3		30	5.00	463	90	122	80	618	214	341	333	448	884		.078	C
4		40	4.00	436	90	115	81	585	214	337	326	434	854	.040	.074	C
5		50	3.80	424	90	113	80	555	214	332	323	429	841	.040	.071	C
6		60	3.33	375	90	108	81	521	215	326	322	429	732	.041	.062	C
7		70														
8		80														
9		90														
10		100														
11		110														
12		120														
13		130														
14		140														
15		150														
16		160														
17		170														
18		180														
19		190														
20		200														
21		210														
22		220														
23		230														
24		240														
25		250														

Comments: 9:44 0.62 lbs added 19.7%
10:01 Five stabred 1 min

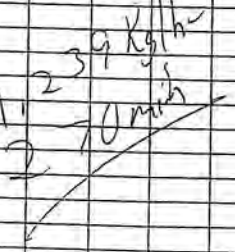
WHI LTO#: J20049092 Air Control full closed

MANUFACTURER: Monsd MODEL: 3600 FIRE SIZE: 1 cu

SWITCH NUMBER: DATE: 8/16/01 RUN#: 1 TECHNICIAN:

READING#	REAL TIME	ELAPSED TIME	WEIGHT REMAIN.	CO	CO_2	O_2	1 FLUE GAS TEMP	2 ROOM TEMP	3 TUNNEL TEMP	4 TUNNEL WET BULB	5 UNIT TOP	6 UNIT BACK	7 UNIT RT. SIDE	8 UNIT LEFT SIDE	9 UNIT BOTTOM	10 CAT EXIT	11 CAT CENTER	12	13
0	16:02	0	14.87	1.23	7.15	12.31	375	90	108	81	521	215	326	322	429	732			
1		10	13.00	1.78	5.12	14.11	438	90	128	82	557	206	314	320	450	828			
2		20	11.40	.33	13.44	6.46	521	90	127	82	555	206	299	306	440	1049			
3		30	9.40	.35	13.98	6.35	536	90	128	82	595	202	292	307	424	1111			
4		40	7.70	.65	14.79	5.47	547	90	129	83	630	203	295	313	407	1170			
5		50	6.40	.39	14.01	6.16	522	90	126	83	648	205	302	327	388	1064			
6		60	5.40	.97	10.09	9.66	458	90	120	82	625	204	310	333	375	846			
7		70	4.70	1.51	7.63	11.81	389	90	114	82	553	207	316	333	370	738			
8		80	4.10	1.28	7.65	11.93	358	90	110	82	503	207	313	330	370	690			
9		90	3.50	1.16	8.24	11.31	358	90	108	81	479	207	307	327	373	696			
10		100	3.00	.58	8.52	11.13	353	90	106	81	474	206	304	327	379	672			
11		110	2.70	.36	7.85	11.93	332	90	105	81	460	206	301	328	385	627			
12		120	2.40	.49	7.44	12.40	315	90	102	80	438	205	299	326	391	601			
13		130	2.30	.74	7.26	12.47	305	90	101	80	420	206	297	324	393	576			
14		140	2.10	.89	6.72	12.96	292	90	101	80	403	205	295	323	395	552			
15		150	2.00	.87	6.52	13.21	280	90	99	80	387	206	290	319	395	530			
16		160	1.80	1.01	6.27	13.43	273	90	99	80	375	205	286	312	395	517			
17		170	1.70	1.31	6.02	13.54	270	90	98	80	366	201	282	308	395	511			
18		180	1.60	1.46	5.84	13.71	266	90	98	80	360	199	278	304	394	503			
19		190	1.40	1.70	5.41	14.06	259	90	98	80	350	197	274	300	393	490			
20		200	1.30	1.65	5.29	14.16	253	90	98	81	340	195	271	295	391	476			
21		210	1.20	1.61	5.18	14.24	249	90	97	81	331	195	267	291	388	468			
22		220	1.00	1.58	5.18	14.32	246	90	97	81	324	194	265	287	385	465			
23		230	.90	1.75	5.12	14.30	247	90	97	81	320	194	261	285	381	456			
24		240	.80	1.84	4.94	14.49	247	90	97	80	319	194	259	280	378	456			
25		250	.30	1.85	4.87	14.63	241	90	97	80	315	191	258	278	375	453			
26		260	.10	1.64	5.11	14.48	242	90	97	81	311	190	257	277	374	466			
27		270	0.00	1.56	5.17	14.43	239	90	96	80	307	189	256	274	374	473			
28		280																	
29		290																	
30		300																	
31		310																	
32		320																	
33		330																	
34		340																	
35		350																	
36		360																	
37		370																	
38		380																	
39		390																	
40		400																	
41		410																	
42		420																	
43		430																	
44		440																	
45		450																	
46		460																	
47		470																	
48		480																	

GAS SAMPL ROTO.	DGM #1 READING	ROTO 1 READING	17 DGM TEMP INLET	18 DGM TEMP OUTLET	19 FILTER TEMP	DGM #2 READING	ROTO 2 READING	20 DGM TEMP INLET	21 DGM TEMP OUTLET	22 FILTER TEMP	TUNNEL VELOCITY	DRAFT	SMOKE	MAX DGM PRESS
135	240.1	120	79	78	79	586.4	120	76	76	80	.040	.065	C	0
135	242.5	120	79	78	89	588.7	120	77	76	89	.040	.081	C	2
135	244.9	120	80	79	89	591.1	120	79	77	89	.039	.084	C	2
135	247.2	120	81	80	90	593.5	120	79	78	90	.040	.086	C	2
135	249.6	120	82	81	90	595.9	120	81	79	90	.040	.086	C	2
135	252.0	120	83	82	90	598.2	120	82	80	90	.040	.084	C	2
135	254.4	120	84	83	90	600.6	120	83	81	90	.040	.079	C	2
135	256.8	120	85	84	90	603.0	120	84	82	90	.040	.070	C	2
135	259.1	120	86	85	90	605.3	120	85	84	90	.040	.067	C	2
135	261.5	120	86	86	90	607.7	120	85	83	90	.040	.066	C	2
135	263.9	120	87	87	90	610.1	120	86	85	90	.041	.065	C	2
135	266.3	120	88	88	89	612.5	120	87	85	90	.040	.061	C	2
135	268.7	120	88	88	89	614.9	120	87	86	89	.040	.059	C	2
135	271.1	120	88	88	88	617.3	120	87	86	89	.040	.057	C	2
135	273.5	120	89	89	89	619.7	120	88	87	89	.040	.055	C	2
135	275.9	120	89	90	88	622.1	120	88	87	88	.040	.054	C	2
135	278.3	120	90	90	88	624.5	120	88	88	88	.039	.052	C	2
135	280.7	120	90	90	88	626.9	120	88	88	89	.040	.051	C	2
135	283.1	120	89	90	88	629.3	120	88	88	89	.040	.050	C	2
135	285.5	120	89	90	88	631.7	120	88	89	88	.040	.049	C	2
135	287.9	120	89	90	88	634.1	120	88	88	88	.041	.048	C	2
135	290.3	120	89	90	88	636.5	120	88	88	88	.040	.047	C	2
135	292.7	120	89	89	88	638.9	120	88	89	88	.040	.046	C	2
135	295.1	120	88	89	88	641.3	120	88	88	88	.041	.046	C	2
135	297.5	120	88	88	87	643.7	120	88	88	87	.040	.046	C	2
135	299.9	120	89	89	87	646.1	120	88	88	87	.041	.046	C	2
135	302.3	120	89	89	88	648.5	120	88	88	88	.040	.046	C	2
135	304.7	120	88	89	86	650.9	120	88	88	87	.040	.046	C	2



COMMENTS: Test loaded @ 35sec

TEST LOADED IN 30 SECONDS door open 90 sec air control open 5 min

Manufacturer Morso Model 3600 Date 8/7/02

Job # J20049092 Run 2 Tech

PRETEST DILUTION TUNNEL TRAVERSE RUN

Barometric pressure (P_{bar}) 29.28 (inches Hg.) Static pressure (P_q) .114 (inches w.c.)
Inside diameter: Port A 6in. Port B 6in. Tunnel cross sectional area: 0.1963Ft²
Pitot tube type: Standard

Traverse Point	Position (inches)	Velocity Head Δ_p (inches H_2O)	Tunnel Temperature (°F)	$\sqrt{\Delta p}$
A-Centroid	3.00	.040	121	.2000
B-Centroid	3.00	.040	123	.2000
A-1	0.40	.036	123	.1897
A-2	1.50	.040	123	.2000
A-3	4.50	.040	121	.2000
A-4	5.60	.035	123	.1871
B-1	0.40	.038	121	.1949
B-2	1.50	.040	122	.2000
B-3	4.50	.040	123	.2000
B-4	5.60	.035	120	.1871
		AVERAGE	121.8	.1959

Adjustment factor application

$$V_s = K_p C_p F_p \left(\sqrt{\Delta_p}\right) AVG \sqrt{\frac{T_s}{P_s M_s}} \qquad V_s = K_p C_p \left(\sqrt{\Delta_p}\right) avg \sqrt{\frac{T_s}{P_s M_s}}$$

Pitot correction .9794

Where,
C_p = Pitot tube coefficient = 0.99 for standard pitot
Δ_p = manometer reading (inches H_2O)
T_s = average absolute dilution tunnel temperature (°F + 460)

$$F_p = \frac{\left(\sqrt{\Delta_p}\right) avg}{\left(\sqrt{\Delta_p}\right) centroid}$$

P_s = absolute dilution tunnel gas pressure or Pbar + P_g $\frac{inches H_2O}{13.6}$
P_g = static pressure

M_s = 28.56, wet molecular weight of stack gas (alternatively, it may be measured)
K_p = 85.49 Pitot tube constant, (conversion factor for English units)

Adjustment factor for alternative Pitot tube placement:

$\left(\sqrt{\Delta_p}\right) avg.$ = Average of the square roots of the velocity heads (Δ_p) measured at each traverse point.

$\left(\sqrt{\Delta_p}\right) centroid$ = Average of the square roots of the velocity heads measured at the tunnel centroid (inches of H_2O)

Manufacturer Morso Model 3600 Date

Job # J20049092 Run 2 Tech

Pre/Post Checks

Moisture Meter Calibration Check:	Time: 6:50	X: ✓	Y: ✓	12: ✓	22: ✓

	Pre-Test	Post-Test
Facility Conditions:		
Air Velocity	0 fpm	0 fpm
Smoke Capture Check	✓	✓
Wood Heater Conditions:		
Date Wood Heater Stack Cleaned	8/14/01	
Date Dilution Tunnel cleaned	8/14/01	
Induced Draft Check	0	0
Tunnel Velocity	.040	.027
Flow Rate 140-cfm ±10%		132.155
Pitot Leak Check:		
Side A	✓	✓
Side B	✓	✓
Temperature System:		
Ambient (65°- 90°F)		88.8 °F
Wood Heater Surface (±125°F)		97.8 °F
Proportional Checks:		
CO Analyzer Drift Check		✓
CO_2 Analyzer Check		✓
O_2 Analyzer Check		✓
Thermocouple check		✓

Sampling Train ID Numbers:	Train 1	Train 2
Probe	3	4
Filter Front	13	15
Filter Back	14	16
Filter Thermocouple	19	22
Filter 5G-3 (<90°F)	✓	✓

Thermocouple Identification Number

Flue....1
Dilution Tunnel Wet Bulb....4
Unit Right Side....7
Catalyst/Combustion Chamber....10
Room....2
Unit Top....5
Unit Left Side....8
Dilution Tunnel Dry Bulb....3
Unit Back....6
Unit Bottom....9

Manufacturer Morso Model 3600 Date 8/7/07

Job # J20049092 Run 2 Tech [illegible]

Pre-Test Scale Audit

Scale Type	Audit Weight	Measured Weight
Platform	10 lbs., Class F	10.0 lbs.
Wood	10 lbs., Class F	10.00 lbs.
Analytical	100 Grams mg, Class S	Grams .999 mg.

LIMITS OF WEIGHT RANGES

ANALYTICAL SCALE:..... 50%-150% of dry filter weight, ± 0.1 mg
PLATFORM SCALE.....20%-80% of ideal test load weight, ± 0.1 lbs. or 1%
WOOD SCALE.....20%-80% of ideal test load weight, ± 0.1 lbs. or 1%

Manufacturer Morso Model 3600 Date 8/7/01

Job # J20049092 Run 2 Tech [illegible]

SAMPLING EQUIPMENT CHECK OUT

Leakage Checks Tunnel Samplers

	SYSTEM 1		SYSTEM 2	
Unplugged Flow Rate = .25cfm	Pre-Test	Post-Test	Pre-Test	Post-Test
Vacuum (inches Hg.)	10	10	10	10
Final 1minute DGM (ft^3)	305.031	393.592	650.951	739.373
Initial 1minute DGM (ft^3)	305.031	393.591	650.951	739.371
Change (C) (ft^3)	0	.001	0	.002
Allowable leakage .04 x Sample rate or .02cfm	0.0100	0.0100	0.0100	0.0100
Check OK	✓	✓	✓	✓

Leakage Checks Flue Gas Sampler

Plugged Probe	Pre Test	Post Test
Vacuum (inches Hg.)	10	10
Rotometer Reading (mm)	0	0
Flow Rate (CFM)	0	0
Allowable (.04 x Sample Rate)		
Check OK	✓	✓

Manufacturer Morso Model 3600 Date 8/7/01

Job # J20049092 Run 2 Tech BK

CONTINUOUS ANALYZERS

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
CO	00.00	00.00	9.96	9.96	.95	.999
CO_2	00.00	00.00	24.65	24.65	9.64	9.99
O_2	00.01	00.00	20.93	20.93	10.28	10.2
	Actual	Should Be	Actual	Should Be	Actual	Should Be

Post Test (Record Only)

	Zero	Span	Cal.	Zero Drift	Span Drift	Cal. Drift	OK?	Not OK*
CO	0.06	10.04	9.96	0	.08	.01	✓	
CO_2	0.00	24.88	9.72	0	.23	.08	✓	
O_2	.04	20.85	10.24	.04	.08	.09	✓	

* Greater than ± 5% of the range used.

Manufacturer Morso Model 3600 Date 8/7/01

Job # J20049092 Run 2 Tech [illegible]

TEST DATA LOG

RAW DRY GAS METER READINGS

	System 1	System 2
Final (ft^3)	393.585	739.363
Initial (ft^3)	305.031	650.951

AMBIENT CONDITIONS

	Start	End
Barometer. (inches Hg)	29.28	29.26
Wet Bulb (°F)		
Dry Bulb (°F)	75	80
Humidity (%)	72	67

ITS Intertek Testing Services

Manufacturer Morso Model 3600 Date 8/4/01

Job # J20049092 Run 2 Tech [illegible]

DILUTION TUNNEL PARTICULATE SAMPLER DATA

FILTER TYPE: Gelman 47mm A/E

Samples in Desecrator. Date: Time:

	SYSTEM 1		SYSTEM 2	
	Probe and Front Half Housing # 3	Filter Numbers 13 14	Probe and Front Half Housing # 4	Filter Numbers 15, 16
Post Test Weight:	93.1153 grams	.2417 grams	89.9660 grams	.2302 grams
Pre Test Weight:	93.1136 grams	.2305 grams	89.9651 grams	.2169 Grams
Gain:	.0017 grams	.0112 grams	.0009 grams	.0133 Grams
	a1	b1	a2	b2

Total Gain: a1 + b1 = 12.9 m grams a2 + b2 = 14.2 m grams

Pre-test Weight Record		SYSTEM 1			SYSTEM 2				
Date	Time	Probe & Housing Number	Front Filter Number	Back Filter Number	Probe & Housing Number	Front Filter Number	Back Filter Number	TEMP	HUM
		3	13	14	4	15	16	°F	%
8/4/01	10:05	93.1134	.1151	.1154	89.9651	.1031	.1143	76	43
8/5/01	9:25	93.1139	.1151	.1153	89.9651	.1032	.1141	76	48
8/6/01	6:15	93.1139	.1151	.1154	89.9651	.1031	.1139	76	49
8/7/01	5:50	93.1136	.1151	.1154	89.9651	.1030	.1139	76	48
		Total	.2305		Total	.2169			

Pre-test Weight Record		SYSTEM 1		SYSTEM 2			
Date	Time	Probe & Housing Number	Combined Filter Weight Number	Probe & Housing Number	Combined Filter Weight Number	TEMP	HUM
		3	13, 14	4	15, 16	°F	%
8/7/01	1607	93.1162	.2426	89.9678	.2331	87	47
8/8/01	7:05	93.1154	.2419	89.9674	.2308	74	45
8/9/01	7:15	93.1153	.2418	89.9663	.2305	74	48
8/10/01	7:25	93.1153	.2417	89.9660	.2304	72	46
8/13/01	8:25	93.1153	.2417	89.9660	.2302	75	48

Manufacturer Morso Model 3600 Date 8/7/01

Job # J20049092 Run 2 Tech [illegible]

FUEL DATA

PRE-TEST LOAD

FUEL DESCRIPTION:
Kindling weight: 1.9 lbs. Consisting of: Scrap and paper Fire lit Time 8:06
Pre-test load weight: 16.56 lbs. Consisting of: 2X4X10, 19 inches Time loaded: 8:09
Pre-test moisture content: Uncorrected: 18.9 % Corrected Dry: 20.19 % Wet: 16.80 %

Test Air Control Settings: full closed Time: 8:31
Test Unit Fan Settings: Time:

TEST LOAD

	Lower Limit		Ideal		Upper Limit	
Test Load Weight:	13.48	Lbs.	14.98	lbs.	16.48	Lbs.

Fire Box Volume:	2.14	$Ft.^3$	Ideal Length:	20.0	Inches
Load Volume:	.4946	$Ft.^3$	Loading Density:	7.262	lbs/ft^3
Number of Spacers	16	¾x1½x5	Load Density:	31.416	lbs/ft^3

Piece Size	Weight	Meter Moisture Content (% dry)*		
2 x 4 x 19 in.	2.25 lbs.	20.5 %	19.2 %	18.6 %
2 x 4 x 19 in.	2.19 lbs.	19.6 %	18.6 %	18.5 %
2 x 4 x 19 in.	2.50 lbs.	20.5 %	19.0 %	18.7 %
4 x 4 x 19 in.	4.55 lbs.	18.8 %	18.5 %	18.0 %
4 x 4 x 19 in.	4.05 lbs.	19.6 %	18.3 %	20.2 %
x x in.	lbs.	%	%	%
x x in.	lbs.	%	%	%

*Uncorrected range = 17.9% to 23.1%

TEST LOAD WEIGHT: 15.54 lbs. **DRY WEIGHT:** 5.85 kg.
AVERAGE MOISTURE CONTENT:
(DRY) 19.11% CORRECTED TO TWO PIN: (DRY) 20.42 % (WET) 16.96 %

COAL BED RANGE: 3.2 lbs. to 3.8 lbs. (20% to 25% of test load)
TEST CHARGE:
Time loaded: 9:47 Coal bed weight: 3.4 lbs. Coal bed weight = 21.8 % of test load weight

CHARCOALIZATION: good |X|-|-|-|-|-|-|-|-|-|--|--|--|--|-|-|-|-|-| poor

ITS Intertek Testing Services

Manufacturer Morso Model 3600 Date 8/7/01

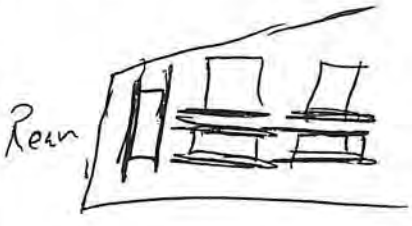
Job # J20049092 Run 2 Tech [illegible]

COMMENTS

6:43 2.7 lbs kindling started
6:48 10.8 lbs kindling added
7:27 2.1 lbs kindling added

8:00 Stove cleaned out
8:06 1.8 lbs kindling started
8:09 8.74 lbs of preload added
8:24 Rest of preload added

TEST LOAD CONFIGURATION



Manufacturer Morso Model 3600 Date 8/7/01

Job # J20049092 Run 2 Tech [illegible]

Air control full closed

SWITCH NUMBER				1	2	3	4	5	6	7	8	9	10			
READING #	REAL TIME	ELAPSED TIME	WEIGHT REMAINING	FLUE GAS TEMP	ROOM TEMP	TUNNEL DRY BULB	TUNNEL WET BULB	UNIT TOP	UNIT BACK	UNIT RIGHT SIDE	UNIT LEFT SIDE	UNIT BOTTOM	CATALYST DOWNSTREAM	TUNNEL VELOCITY	DRAFT	SMOKE
0	8:32	0	9.60	714	89	171	83	696	164	325	364	331	1098	.040	.091	T
1		10	8.90	469	89	123	80	564	177	336	361	373	800	.041	.078	T
2		20	8.00	459	90	123	79	542	180	325	345	382	974		.080	T
3		30	6.90	461	90	122	79	565	183	317	333	385	969		.080	C
4		40	5.50	454	90	120	79	578	185	316	328	387	879	.040	.079	C
5		50	4.70	430	89	117	80	572	187	320	323	391	841	.040	.076	C
6		60	4.00	402	90	113	80	549	190	322	321	395	748	.040	.071	C
7		70	3.60	338	90	107	79	505	192	321	317	402	617	.040	.064	C
8		80														
9		90														
10		100														
11		110														
12		120														
13		130														
14		140														
15		150														
16		160														
17		170														
18		180														
19		190														
20		200														
21		210														
22		220														
23		230														
24		240														
25		250														

Comments: 8:36 0.66 lbs @ 192 added
9:46 five stirred, door open 1 min

MANUFACTURER: Monso MODEL: 3606 FIRE SIZE: Low DATE: 8/7/01 RUN#: 2 TECHNICIAN:

READING#	REAL TIME	ELAPSED TIME	WEIGHT REMAIN	CO	CO_2	O_2	1 FLUE GAS TEMP	2 ROOM TEMP	3 TUNNEL TEMP	4 TUNNEL WET BULB	5 UNIT TOP	6 UNIT BACK	7 UNIT RT. SIDE	8 UNIT LEFT SIDE	9 UNIT BOTTOM	10 CAT. INLET	11 CAT. CENTER	12	13	GAS SAMPL BOYD.	1 DGM #1 READING	MOTO 1 READING	17 HEAT TEMP INLET	18 DGM TEMP OUTLET	19 FILTER TEMP	1 DGM #2 READING	MOTO 2 READING	20 DGM TEMP INLET	21 DGM TEMP OUTLET	22 FILTER TEMP	TUNNEL VELOCITY	PBAR	SMOKE	MAN. DGM PRESS
0	9:47	0	15.54	.51	7.90	11.90	324	90	106	79	488	192	319	315	405	601																			
1		10	14.10	.84	5.96	14.01	434	90	125	80	500	182	303	301	455	846				135	305.0	120	79	79	78	650.9	120	77	77	78	.040	.070	C	0
2		20	12.90	.40	11.03	9.28	480	90	124	80	527	184	287	284	446	973				135	307.4	120	81	79	89	653.3	120	79	78	89	.039	.082	T	2
3		30	11.40	.35	13.72	6.91	515	90	128	81	562	181	278	286	429	1080				135	309.8	120	82	80	88	656.7	120	80	78	90	.039	.084	T	2
4		40	10.20	.48	14.20	6.35	527	89	129	81	008	180	283	297	409	1117				135	312.1	120	83	81	88	658.1	120	82	80	90	.038	.088	T	2
5		50	8.60	.48	14.74	5.59	544	90	130	82	641	181	295	310	389	1150				135	314.5	120	84	83	88	660.5	120	82	86	90	.038	.089	T	2
6		60	6.80	.28	13.09	7.30	509	90	128	83	657	184	307	323	373	1033				135	316.9	120	84	83	89	662.9	120	83	82	90	.038	.089	C	2
7		70	5.90	.49	9.51	10.65	459	90	122	83	620	184	317	335	364	840				135	319.3	120	85	84	89	665.3	120	84	83	90	.038	.087	C	2
8		80	5.30	.60	8.90	11.20	406	90	118	83	569	192	321	338	360	770				135	321.7	120	86	85	89	667.7	120	85	84	90	.038	.080	C	2
9		90	5.00	.91	8.61	11.28	393	90	115	83	540	193	321	337	362	746				135	324.0	120	87	86	89	670.1	120	86	84	90	.038	.076	C	2
10		100	4.70	.77	7.27	12.51	351	90	110	83	504	195	319	337	364	673				135	326.4	120	88	87	88	672.5	120	87	86	89	.039	.073	C	2
11		110	4.40	.66	7.03	12.73	332	89	108	82	472	195	314	333	369	631				135	328.8	120	87	87	88	674.9	120	86	86	89	.040	.068	C	2
12		120	4.20	.40	6.99	12.96	315	89	106	82	445	196	309	328	375	606				135	331.2	120	86	86	87	677.3	120	87	87	89	.039	.064	C	2
13		130	4.00	.63	6.57	13.21	301	90	104	82	423	196	304	323	374	580				135	333.6	120	86	86	87	679.6	120	87	88	89	.039	.061	C	2
14		140	3.80	.74	6.59	13.11	294	90	103	82	407	195	300	318	383	561				135	336.0	120	86	86	87	682.0	120	88	88	88	.038	.059	C	2
15		150	3.60	.87	6.01	13.74	281	89	102	82	395	194	295	315	387	555				135	338.4	120	86	86	87	684.4	120	88	88	88	.039	.059	C	2
16		160	3.50	.85	5.77	13.95	268	89	101	82	377	192	291	309	391	513				135	340.8	120	87	87	87	686.8	120	88	89	89	.039	.055	C	2
17		170	3.30	1.08	5.54	14.08	263	89	101	82	363	191	285	305	393	502				135	343.2	120	87	87	87	689.2	120	87	88	88	.038	.054	C	2
18		180	3.20	1.22	5.47	14.08	257	89	100	82	353	190	280	300	393	492				135	345.6	120	87	87	87	691.6	120	87	88	89	.039	.051	C	2
19		190	2.90	1.18	5.55	14.00	254	89	100	83	346	189	276	297	392	486				135	347.9	120	86	87	87	693.9	120	86	87	89	.039	.051	C	2
20		200	2.70	1.41	5.29	14.17	250	88	100	82	339	188	273	292	391	477				135	350.3	120	86	87	87	696.3	120	86	87	88	.038	.050	C	2
21		210	2.60	1.32	5.33	14.26	247	88	100	82	334	187	270	289	389	472				135	352.7	120	86	87	88	698.7	120	85	87	89	.037	.050	C	2
22		220	2.40	1.42	5.24	14.21	246	88	99	82	329	186	267	285	387	469				135	355.1	120	86	86	88	701.0	120	85	86	89	.038	.049	C	2
23		230	2.20	1.65	4.66	14.58	241	88	99	82	324	186	264	281	387	460				135	357.5	120	86	86	88	703.4	120	85	86	89	.039	.048	C	2
24		240	2.10	1.82	4.46	14.70	237	89	100	83	318	185	261	278	386	450				135	359.9	120	86	86	87	705.8	120	85	86	88	.038	.048	C	2
25		250	1.90	1.83	4.40	14.76	233	88	99	82	312	184	258	275	384	439				135	362.3	120	86	86	88	708.2	120	86	86	89	.038	.047	C	2
26		260	1.80	1.72	4.29	14.98	231	88	99	82	306	183	255	271	383	436				135	364.7	120	86	86	88	710.6	120	85	85	88	.036	.047	C	2
27		270	1.60	1.90	3.93	15.15	225	88	98	82	300	182	252	266	380	427				135	367.1	120	86	86	87	713.0	120	85	85	88	.036	.046	C	2
28		280	1.50	1.83	4.42	14.83	223	88	98	82	295	181	250	261	378	420				135	369.5	120	86	86	87	715.4	120	85	86	88	.037	.045	C	2
29		290	1.20	1.88	4.61	15.14	218	88	97	82	291	180	247	257	375	423				135	372.0	120	86	86	87	717.8	120	85	86	88	.037	.045	C	2
30		300	1.10	1.84	3.68	15.54	213	88	97	82	286	179	245	254	373	401				135	374.4	120	85	86	87	720.2	120	86	86	87	.037	.044	C	2
31		310	1.00	1.77	3.51	15.66	208	88	97	82	280	178	243	251	369	403				135	376.8	120	86	86	87	722.6	120	86	87	88	.037	.043	C	2
32		320	.80	1.85	3.45	15.73	204	88	96	82	275	176	240	246	365	384				135	379.2	120	86	86	87	725.0	120	86	86	88	.037	.042	C	2
33		330	.70	1.88	3.44	15.74	202	88	96	82	271	175	237	242	361	391				135	381.6	120	86	86	87	727.4	120	86	86	88	.038	.041	C	2
34		340	.60	1.87	3.28	15.88	200	88	96	82	267	173	234	238	356	380				135	383.9	120	86	86	87	729.7	120	86	86	88	.037	.040	C	2
35		350	.40	1.68	3.60	15.77	202	88	96	83	263	172	231	235	353	393				135	386.3	120	86	86	87	732.1	120	86	86	88	.036	.040	C	2
36		360	.20	1.89	3.47	15.22	201	88	97	82	260	170	230	231	349	393				135	388.7	120	86	86	87	734.5	120	86	86	88	.038	.040	C	2
37		370	0.00	1.86	3.48	15.73	202	88	96	83	258	169	229	230	344	394				135	391.1	120	86	86	87	736.9	120	85	86	88	.038	.040	C	2
38		380																		135	395.5	120	87	86	87	739.3	120	86	86	87	.037	.040	C	2
39		390																																
40		400																																
41		410																																
42		420																																
43		430																																
44		440																																
45		450																																
46		460																																
47		470																																
48		480																																

3 70 min Kg/hr
0 40

COMMENTS:

TEST LOADED IN 30 SECONDS · door open 90 sec air control full open for 3½ min then slowly closed till 5 min

Manufacturer Morso Model 3600 Date 8/8/01

Job # J20049092 Run 3 Tech AL/

PRETEST DILUTION TUNNEL TRAVERSE RUN

Barometric pressure (P_{bar}) 29.04 (inches Hg.) Static pressure (P_q) .105 (inches w.c.)
Inside diameter: Port A 6in. Port B 6in. Tunnel cross sectional area: 0.1963Ft²
Pitot tube type: Standard

Traverse Point	Position (inches)	Velocity Head Δ_p (inches H_2O)	Tunnel Temperature (°F)	$\sqrt{\Delta p}$
A-Centroid	3.00	.059	209	0.2429
B-Centroid	3.00	.060	195	0.2449
A-1	0.40	.054	202	0.2324
A-2	1.50	.059	206	0.2429
A-3	4.50	.059	205	0.2429
A-4	5.60	.055	204	0.2345
B-1	0.40	.056	196	0.2366
B-2	1.50	.060	196	0.2449
B-3	4.50	.060	199	0.2449
B-4	5.60	.054	196	0.2324
		AVERAGE	200.8	0.2399

Adjustment factor application

$$V_s = K_p C_p F_p \left(\sqrt{\Delta_p}\right) AVG \sqrt{\frac{T_s}{P_s M_s}} \qquad V_s = K_p C_p \left(\sqrt{\Delta_p}\right) avg \sqrt{\frac{T_s}{P_s M_s}}$$

Pitot correction 0.9837

Where,
C_p = Pitot tube coefficient = 0.99 for standard pitot
Δ_p = manometer reading (inches H_2O)
T_s = average absolute dilution tunnel temperature (°F + 460)

$$F_p = \frac{\left(\sqrt{\Delta_p}\right) avg}{\left(\sqrt{\Delta_p}\right) centroid}$$

P_s = absolute dilution tunnel gas pressure or Pbar + P_g $\quad \frac{inches H_2O}{13.6}$
P_g = static pressure

M_s = 28.56, wet molecular weight of stack gas (alternatively, it may be measured)
K_p = 85.49 Pitot tube constant, (conversion factor for English units)

Adjustment factor for alternative Pitot tube placement:

$\left(\sqrt{\Delta_p}\right) avg.$ = Average of the square roots of the velocity heads (Δ_p) measured at each traverse point.

$\left(\sqrt{\Delta_p}\right) centroid$ = Average of the square roots of the velocity heads measured at the tunnel centroid (inches of H_2O)

ITS Intertek Testing Services

Manufacturer Morso Model 3600 Date 8/8/01

Job # J20049092 Run 3 Tech [illegible]

Pre/Post Checks

Moisture Meter Calibration Check:

Time: 7:50	X: ✓	Y: ✓	12: ✓	22: ✓

	Pre-Test	Post-Test
Facility Conditions:		
Air Velocity	0 fpm	0 fpm
Smoke Capture Check	✓	✓
Wood Heater Conditions:		
Date Wood Heater Stack Cleaned	8/4/01	
Date Dilution Tunnel cleaned	8/4/01	
Induced Draft Check	0	0
Tunnel Velocity	.052	.051
Flow Rate 140-cfm ±10%		142.244
Pitot Leak Check:		
Side A	✓	✓
Side B	✓	✓
Temperature System:		
Ambient (65°- 90°F)	89.8 °F	
Wood Heater Surface (±125°F)	-14.6 °F	
Proportional Checks:		
CO Analyzer Drift Check	✓	
CO_2 Analyzer Check	✓	
O_2 Analyzer Check	✓	
Thermocouple check	✓	

Sampling Train ID Numbers:	Train 1	Train 2
Probe	5	6
Filter Front	17	19
Filter Back	18	20
Filter Thermocouple	19	22
Filter 5G-3 (<90°F)	✓	✓

Thermocouple Identification Number

Flue....1
Dilution Tunnel Wet Bulb....4
Unit Right Side....7
Catalyst/Combustion Chamber....10
Room....2
Unit Top....5
Unit Left Side....8
Dilution Tunnel Dry Bulb....3
Unit Back....6
Unit Bottom....9

Manufacturer Morso Model 3600 Date 8/18/07

Job # J20049092 Run 3 Tech [illegible]

Pre-Test Scale Audit

Scale Type	Audit Weight	Measured Weight
Platform	10 lbs., Class F	10.0 lbs.
Wood	10 lbs., Class F	10.00 lbs.
Analytical	100 Grams mg, Class S	Grams 100.0 mg.

LIMITS OF WEIGHT RANGES

ANALYTICAL SCALE: ..... 50%-150% of dry filter weight, ± 0.1 mg
PLATFORM SCALE ..... 20%-80% of ideal test load weight, ± 0.1 lbs. or 1%
WOOD SCALE ..... 20%-80% of ideal test load weight, ± 0.1 lbs. or 1%

Manufacturer Morso Model 3600 Date 8/8/07

Job # J20049092 Run 3 Tech MK/AL

SAMPLING EQUIPMENT CHECK OUT

Leakage Checks Tunnel Samplers

	SYSTEM 1		SYSTEM 2	
Unplugged Flow Rate = .25cfm	Pre-Test	Post-Test	Pre-Test	Post-Test
Vacuum (inches Hg.)	10"	10"	10"	10"
Final 1minute DGM (ft^3)	393.620	414.063	739.374	759.585
Initial 1minute DGM (ft^3)	393.620	414.063	739.374	759.585
Change (C) (ft^3)	0	0	0	0
Allowable leakage .04 x Sample rate or .02cfm	0.0100	0.0100	0.0100	0.0100
Check OK	✓	✓	✓	✓

Leakage Checks Flue Gas Sampler

Plugged Probe	Pre Test	Post Test
Vacuum (inches Hg.)	10"	10"
Rotometer Reading (mm)	0	0
Flow Rate (CFM)	0	0
Allowable (.04 x Sample Rate)		
Check OK	✓	✓

ITS Intertek Testing Services

Manufacturer Morso Model 3600 Date 8/8/07

Job # J20049092 Run 3 Tech AL

CONTINUOUS ANALYZERS

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
CO	00.00	00.00	9.96	9.96	.95	.999
CO_2	00.00	00.00	24.65	24.65	9.64	9.99
O_2	00.01	00.00	20.92	20.93	10.20	10.2
	Actual	Should Be	Actual	Should Be	Actual	Should Be

Post Test (Record Only)

	Zero	Span	Cal.	Zero Drift	Span Drift	Cal. Drift	OK?	Not OK*
CO	00.00	10.08	.97	0	.12	.02	✓	
CO_2	00.02	25.04	9.98	.02	.39	.13	✓	
O_2	00.02	20.62	10.16	.02	.30	.04	✓	

* Greater than ± 5% of the range used.

Manufacturer Morso Model 3600 Date 8/18/01

Job # J20049092 Run 3 Tech

TEST DATA LOG

RAW DRY GAS METER READINGS

	System 1	System 2
Final (ft^3)	414.044	759.571
Initial (ft^3)	393.620	739.374

AMBIENT CONDITIONS

	Start	End
Barometer. (inches Hg)	29.04	29.03
Wet Bulb (°F)		
Dry Bulb (°F)	74	86.2
Humidity (%)	74	61.7

Manufacturer Morso Model 3600 Date 8/5/01

Job # J20049092 Run 3 Tech [illegible]

DILUTION TUNNEL PARTICULATE SAMPLER DATA

FILTER TYPE: Gelman 47mm A/E

Samples in Desecrator. Date: Time:

	SYSTEM 1		SYSTEM 2	
	Probe and Front Half Housing # 5	Filter Numbers 17, 18	Probe and Front Half Housing # 6	Filter Numbers 19, 20
Post Test Weight:	91.0570 grams	.2415 grams	91.5665 grams	.2286 grams
Pre Test Weight:	91.0566 grams	.2278 grams	91.5661 grams	.2155 Grams
Gain:	.0004 grams	.0137 grams	.0008 grams	.0131 Grams
	a1	b1	a2	b2

Total Gain: a1 + b1 = 14.1m grams a2 + b2 = 13.9m grams

Pre-test Weight Record		SYSTEM 1			SYSTEM 2				
		Probe & Housing Number	Front Filter Number	Back Filter Number	Probe & Housing Number	Front Filter Number	Back Filter Number	TEMP	HUMID
Date	Time	5	17	18	6	19	20	°F	%
8/5/01	9:30	91.0573	.1150	.1132	91.5665	.1026	.1142	76	48
8/6/01	6:20	91.0570	.1151	.1130	91.5661	.1023	.1139	76	49
8/7/01	5:55	91.0566	.1149	.1129	91.5661	.1022	.1137	75	48
8/8/01	7:10	91.0566	.1149	.1129	91.5661	.1020	.1135	74	45
		Total	.2278		Total	.2155			

Pre-test Weight Record		SYSTEM 1		SYSTEM 2			
		Probe & Housing Number	Combined Filter Weight Number	Probe & Housing Number	Combined Filter Weight Number	TEMP	HUMID
Date	Time	5	17, 18	6	19, 20	°F	%
8/8/01	11:40	91.2654	.2464	91.6229	.2301	85	49
8/9/01	7:18	91.0581	.2418	91.5672	.2300	73	48
8/10/01	7:30	91.0571	.2417	91.5670	.2289	72	46
8/13/01	8:20	91.0570	.2415	91.5669	.2286	75	48

Manufacturer Morso Model 3600 Date 8/8/01

Job # J20049092 Run 3 Tech MK

FUEL DATA

PRE-TEST LOAD

FUEL DESCRIPTION:
Kindling weight: 4.4 lbs. Consisting of: Scrap and paper Fire lit Time 8:40
Pre-test load weight: 15.50 lbs. Consisting of: 2X4X10, 19 inches Time loaded: 8:46
Pre-test moisture content: Uncorrected: 20.56 % Corrected Dry: 22.04 % Wet: 18.06 %

Test Air Control Settings: Tu. 11 open Time: 8:40
Test Unit Fan Settings: Time:

TEST LOAD

	Lower Limit	Ideal	Upper Limit
Test Load Weight:	13.48 Lbs.	14.98 lbs.	16.48 Lbs.

Fire Box Volume:	2.14 Ft.^{3}	Ideal Length:	20 ~~19~~ Inches
Load Volume:	0.4946 Ft.^{3}	Loading Density:	7.332 lbs/ft^3
Number of Spacers	16 ¾x1½x5	Load Density:	31.720 lbs/ft^3

Piece Size	Weight	Meter Moisture Content (% dry)*		
2 x 4 x 19 in.	2.29 lbs.	20.5 %	21.5 %	19.9 %
2 x 4 x 19 in.	2.43 lbs.	23.1 %	22.0 %	18.3 %
2 x 4 x 19 in.	2.38 lbs.	23.1 %	20.0 %	18.8 %
4 x 4 x 19 in.	4.46 lbs.	22.2 %	22.0 %	23.1 %
4 x 4 x 19 in.	4.13 lbs.	19.7 %	19.4 %	19.9 %
x x in.	lbs.	%	%	%
x x in.	lbs.	%	%	%

*Uncorrected range = 17.9% to 23.1%

TEST LOAD WEIGHT: 15.69 lbs. **DRY WEIGHT:** 5.81 kg.
AVERAGE MOISTURE CONTENT:
(DRY) 20.90 % CORRECTED TO TWO PIN: (DRY) 22.44 % (WET) 18.32 %

COAL BED RANGE: 3.2 lbs. to 3.9 lbs. (20% to 25% of test load)
TEST CHARGE:
Time loaded: ~~10~~ 10:05 MK Coal bed weight: 3.2 lbs. Coal bed weight = 20.4 % of test load weight

CHARCOALIZATION: good |~~10~~|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-| poor

ITS Intertek Testing Services

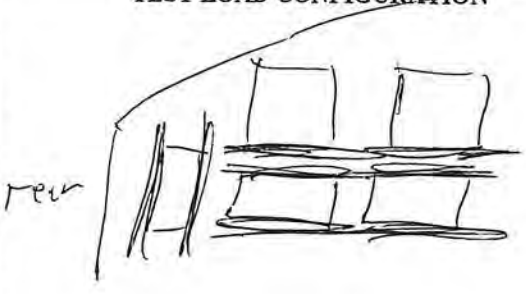
Manufacturer Morso Model 3600 Date 8/18/01

Job # J20049092 Run 3 Tech WK

COMMENTS

FED 2 X 4 X 10 6.52 LBS AT 9:34 AM
WITH MOISTURE CONTENT OF 20-3

TEST LOAD CONFIGURATION



Manufacturer Morso Model 3600 Date 8/8/01

Job # J20049092 Run 3 Tech BK

Air control full open

SWITCH NUMBER			1	2	3	4	5	6	7	8	9	10				
READING #	REAL TIME	ELAPSED TIME	WEIGHT REMAINING	FLUE GAS TEMP	ROOM TEMP	TUNNEL DRY BULB	TUNNEL WET BULB	UNIT TOP	UNIT BACK	UNIT RIGHT SIDE	UNIT LEFT SIDE	UNIT BOTTOM	CATALYST DOWNSTREAM	TUNNEL VELOCITY	DRAFT	SMOKE
0	5:47	0	17.70	791	73	208	69	172	73	76	78	74	694		.050	17
1	.	10	14.30	743	75	202	71	316	85	113	125	92	1293		.101	T
2	.	20	10.70	836	77	235	74	517	102	155	201	133	1317		.106	C
3	.	30	7.60	843	80	229	76	651	125	222	296	194	1320		.106	C
4	.	40	5.10	795	84	205	79	712	147	301	376	286	1129		.101	C
5	.	50	8.20	788	86	209	80	659	107	360	411	427	1204		.101	C
6		60	6.40	735	88	202	82	665	182	384	423	486	1162		.099	C
7		70	4.30	681	88	188	82	642	192	347	440	530	1099		.096	C
8		80														
9		90														
10		100														
11		110														
12		120														
13		130														
14		140														
15		150														
16		160														
17		170														
18		180														
19		190														
20		200														
21		210														
22		220														
23		230														
24		240														
25		250														

Comments:

FED 6.52 LB OF PRETEST AT 9:34 A.M 2x4x10

6.52 LB

20.3 MOIST CONT

10:04 Fire started 20sec

WHI LTO#: J20049092 Air control full open

MANUFACTURER: Maxon MODEL: 5600 FIRE SIZE: High DATE: 5/8/01 RUN#: 3

SWITCH NUMBER: TECHNICIAN: AL

READING#	REAL TIME	ELAPSED TIME	WEIGHT REMAIN.	CO	CO_2	O_2	1 FLUE GAS TEMP	2 ROOM TEMP	3 TUNNEL TEMP	4 TUNNEL WET BULB	5 UNIT TOP	6 UNIT BACK	7 UNIT RT. SIDE	8 UNIT LEFT SIDE	9 UNIT BOTTOM	10 CAT EXIT	CAT CENTER	12	13	GAS SMPL ROTO.	DGM #1 READING	ROTO 1 READING	17 DGM TEMP INLET	18 DGM TEMP OUTLET	19 FILTER TEMP	DGM #2 READING	ROTO 2 READING	20 DGM TEMP INLET	21 DGM TEMP OUTLET	22 FILTER TEMP	TUNNEL VELOCITY	DRAFT	SMOKE	MAX HGM PRESS
0	10:05	0	15.69	.002	0.19	19.79	658	88	185	82	621	201	399	446	556	1070																			
1		10	11.20	.25	19.71	0.41	1046	90	266	86	761	208	592	427	592	1694				135	393.6	120	78	78	76	735.3	120	76	76	77	.057	.096	C	2
2		20	7.30	.10	18.20	1.66	994	90	258	88	860	213	400	432	582	1638				135	396.0	120	80	78	90	741.7	120	78	76	90	.050	.116	C	8
3		30	3.70	.04	13.65	6.13	855	90	237	89	866	223	423	463	579	1377				135	398.4	120	81	79	90	744.0	120	79	77	90	.049	.114	C	10
4		40	2.30	.06	9.06	10.99	732	90	210	89	787	230	444	459	588	1144				135	400.8	120	82	81	90	746.4	120	81	78	90	.050	.108	C	8
5		50	1.60	.07	7.38	12.92	659	90	190	87	689	231	442	485	605	1014				135	403.2	120	84	82	90	748.7	120	83	80	90	.052	.101	C	8
6		60	1.00	.11	6.86	13.58	606	90	178	87	612	228	425	469	622	934				135	405.6	120	85	83	90	751.1	120	84	81	90	.053	.096	C	6
7		70	.60	.25	5.70	14.66	554	90	168	86	551	221	413	450	630	851				135	408.0	120	86	85	90	753.5	120	85	83	90	.053	.091	C	6
8		80	.20	.42	5.23	15.07	527	90	161	86	511	214	399	433	633	812				135	410.4	120	87	86	90	755.9	120	86	84	90	.051	.089	C	6
9	85	90	0.00	.58	5.04	15.22	511	90	158	85	492	210	392	424	632	777				135	413.8	120	88	87	90	758.3	120	87	85	90	.051	.086	C	6
10		100																		135	416.0	120	88	88	89	759.5	120	87	86	90	.051	.085	C	6
11		110																																
12		120																																
13		130																																
14		140																																
15		150																																
16		160																																
17		170																																
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41		410																																
42		420																																
43		430																																
44		440																																
45		450																																
46		460																																
47		470																																
48		480																																

Kg/hr

103

4½

85 min

COMMENTS: door open 405ec

TEST LOADED IN 40 SECONDS air control not adjusted

Manufacturer Morso Model 3600 Date 8.9.04

Job # J20049092 Run 4 Tech

PRETEST DILUTION TUNNEL TRAVERSE RUN

Barometric pressure (P_{bar}) 29.00 (inches Hg.) Static pressure (P_q) .119 (inches w.c.)
Inside diameter: Port A 6in. Port B 6in. Tunnel cross sectional area: 0.1963Ft²
Pitot tube type: Standard

Traverse Point	Position (inches)	Velocity Head Δ_p (inches H_2O)	Tunnel Temperature (°F)	$\sqrt{\Delta p}$
A-Centroid	3.00	.040	121	.2000
B-Centroid	3.00	.040	123	.2000
A-1	0.40	.036	123	.1897
A-2	1.50	.040	121	.2000
A-3	4.50	.040	121	.2000
A-4	5.60	.035	123	.1871
B-1	0.40	.038	121	.1949
B-2	1.50	.040	122	.2000
B-3	4.50	.040	123	.2000
B-4	5.60	.035	120	.1871
		AVERAGE	121.8	.1959

Adjustment factor application

$$V_s = K_p C_p F_p \left(\sqrt{\Delta_p}\right) AVG \sqrt{\frac{T_s}{P_s M_s}} \qquad V_s = K_p C_p \left(\sqrt{\Delta_p}\right) avg. \sqrt{\frac{T_s}{P_s M_s}}$$

Pitot correction .9794

Where,
C_p = Pitot tube coefficient = 0.99 for standard pitot
Δ_p = manometer reading (inches H_2O)
T_s = average absolute dilution tunnel temperature (°F + 460)

$$F_p = \frac{\left(\sqrt{\Delta_p}\right) avg}{\left(\sqrt{\Delta_p}\right) centroid}$$

P_s = absolute dilution tunnel gas pressure or Pbar + P_g
P_g = static pressure

$$\frac{inches H_2O}{13.6}$$

M_s = 28.56, wet molecular weight of stack gas (alternatively, it may be measured)
K_p = 85.49 Pitot tube constant, (conversion factor for English units)

Adjustment factor for alternative Pitot tube placement:

$\left(\sqrt{\Delta_p}\right) avg.$ = Average of the square roots of the velocity heads (Δ_p) measured at each traverse point.

$\left(\sqrt{\Delta_p}\right) centroid$ = Average of the square roots of the velocity heads measured at the tunnel centroid (inches of H_2O)

Manufacturer Morso Model 3600 Date 8-9-01

Job # J20049092 Run 4 Tech [illegible]

Pre/Post Checks

Moisture Meter Calibration Check:	Time:	X: ✓	Y: ✓	12: ✓	22: ✓

	Pre-Test	Post-Test
Facility Conditions:		
Air Velocity	0 fpm	0 fpm
Smoke Capture Check	✓	✓
Wood Heater Conditions:		
Date Wood Heater Stack Cleaned	8/4/01	
Date Dilution Tunnel cleaned	8/4/01	
Induced Draft Check	0	0
Tunnel Velocity	.040	.040
Flow Rate 140-cfm ±10%		136.767
Pitot Leak Check:		
Side A	✓	✓
Side B	✓	✓
Temperature System:		
Ambient (65°- 90°F)		88.1 °F
Wood Heater Surface (±125°F)		18.0 °F
Proportional Checks:		
CO Analyzer Drift Check		✓
CO_2 Analyzer Check		✓
O_2 Analyzer Check		✓
Thermocouple check		✓

Sampling Train ID Numbers:	Train 1	Train 2
Probe	7	8
Filter Front	21	23
Filter Back	22	24
Filter Thermocouple	19	22
Filter 5G-3 (<90°F)	✓	✓

Thermocouple Identification Number

Flue....1	Room....2	Dilution Tunnel Dry Bulb....3
Dilution Tunnel Wet Bulb....4	Unit Top....5	Unit Back....6
Unit Right Side....7	Unit Left Side....8	Unit Bottom....9
Catalyst/Combustion Chamber....10		

Manufacturer Morso Model 3600 Date 8-9-01

Job # J20049092 Run 4 Tech [illegible]

Pre-Test Scale Audit

Scale Type	Audit Weight	Measured Weight
Platform	10.0 lbs., Class F	10.0 lbs.
Wood	10. lbs., Class F	10.00 lbs.
Analytical	100 Grams mg, Class S	Grams 1000 mg.

LIMITS OF WEIGHT RANGES

ANALYTICAL SCALE: ..... 50%-150% of dry filter weight, ± 0.1 mg
PLATFORM SCALE ..... 20%-80% of ideal test load weight, ± 0.1 lbs. or 1%
WOOD SCALE ..... 20%-80% of ideal test load weight, ± 0.1 lbs. or 1%

Manufacturer Morso Model 3600 Date 8-9-01

Job # J20049092 Run 4 Tech

SAMPLING EQUIPMENT CHECK OUT

Leakage Checks Tunnel Samplers

	SYSTEM 1		SYSTEM 2	
Unplugged Flow Rate = .25cfm	Pre-Test	Post-Test	Pre-Test	Post-Test
Vacuum (inches Hg.)	10"	10"	10"	10"
Final 1minute DGM (ft^3)	414,366	460.608	759.708	805.913
Initial 1minute DGM (ft^3)	414,365	460.608	759.706	805.911
Change (C) (ft^3)	.001	0	.002	.002
Allowable leakage .04 x Sample rate or .02cfm	0.0100	0.0100	0.0100	0.0100
Check OK	✓	✓	✓	✓

Leakage Checks Flue Gas Sampler

Plugged Probe	Pre Test	Post Test
Vacuum (inches Hg.)	10"	10"
Rotometer Reading (mm)	0	0
Flow Rate (CFM)	0	0
Allowable (.04 x Sample Rate)		
Check OK	✓	✓

Manufacturer Morso Model 3600 Date 8-9-01

Job # J20049092 Run 4 Tech AL

CONTINUOUS ANALYZERS

Pre-Test (Adjust and Record)

	ZERO		SPAN		CAL. (Record Only)	
CO	00.00	00.00	9.96	9.96	.96	.999
CO_2	00.00	00.00	24.65	24.65	9.61	9.99
O_2	00.01	00.00	20.93	20.93	10.23	10.2
	Actual	Should Be	Actual	Should Be	Actual	Should Be

Post Test (Record Only)

	Zero	Span	Cal.	Zero Drift	Span Drift	Cal. Drift	OK?	Not OK*
CO	.02	10.04	.96	.02	.08	0	✓	
CO_2	.05	24.95	9.85	.05	.30	.24	✓	
O_2	.08	20.61	10.26	.08	.32	.03	✓	

* Greater than ± 5% of the range used.

Manufacturer Morso Model 3600 Date 8-9-07

Job # J20049092 Run 4 Tech JL

TEST DATA LOG

RAW DRY GAS METER READINGS

	System 1	System 2
Final (ft^3)	460.600	805.982
Initial (ft^3)	414.366	759.708

AMBIENT CONDITIONS

	Start	End
Barometer. (inches Hg)	29.00	28.96
Wet Bulb (°F)		
Dry Bulb (°F)	73	~~70~~ 74
Humidity (%)	63	70

JL

Manufacturer Morso Model 3600 Date 8/7/01

Job # J20049092 Run 4 Tech mk

DILUTION TUNNEL PARTICULATE SAMPLER DATA

FILTER TYPE: Gelman 47mm A/E

Samples in Desecrator. Date: 8/9/01 Time: 14:10

	SYSTEM 1		SYSTEM 2	
	Probe and Front Half Housing # 7	Filter Numbers 21, 22	Probe and Front Half Housing # 8	Filter Numbers 23, 24
Post Test Weight:	90.9492 grams	.2581 grams	92.1880 grams	.2450 grams
Pre Test Weight:	90.9477 grams	.2296 grams	92.1866 grams	.2167 Grams
Gain:	.0015 grams	.0285 grams	.0014 grams	.0283 Grams
	a1	b1	a2	b2

Total Gain: a1 + b1 = 30.0 m grams a2 + b2 = 29.7 m grams

Pre-test Weight Record		SYSTEM 1 Probe & Housing Number	SYSTEM 1 Front Filter Number	SYSTEM 1 Back Filter Number	SYSTEM 2 Probe & Housing Number	SYSTEM 2 Front Filter Number	SYSTEM 2 Back Filter Number	TEMP	HUMID
Date	Time	7	21	22	8	23	24	°F	%
8/7/01	6:00	90.9485	.1139	.1162	92.1867	.1026	.1143	75	48
8/8/01	7:15	90.9479	.1136	.1160	92.1867	.1024	.1144	74	45
8/9/01	7:20	90.9477	.1136	.1160	92.1866	.1024	.1143	73	48
		Total	.2296		Total	.2167			

Pre-test Weight Record		SYSTEM 1 Probe & Housing Number	SYSTEM 1 Combined Filter Weight Number	SYSTEM 2 Probe & Housing Number	SYSTEM 2 Combined Filter Weight Number	TEMP	HUMID
Date	Time	7	21 22	8	23 24	°F	%
8/9/01	1410	90.9507	.2611	92.1898	.2485	85	49
8/10/01	7:15	90.9493	.2582	92.1881	.2451	72	46
8/13/01	8:25	90.9492	.2581	92.1880	.2450	75	48
8/14/01	1345	90.9492	.2581	92.1880	.2450	75	47

ITS Intertek Testing Services

Manufacturer Morso Model 3600 Date 8-9-01

Job # J20049092 Run 4 Tech ML

FUEL DATA

PRE-TEST LOAD

FUEL DESCRIPTION:

Kindling weight: 2.3 lbs. Consisting of: Scrap and paper Fire lit Time 9:02

Pre-test load weight: 15.31 lbs. Consisting of: 2X4X10, 19 inches Time loaded: 9:16

Pre-test moisture content: Uncorrected: 19.78 % Corrected Dry: 21.16 % Wet: 17.46 %

Test Air Control Settings: 1 7/8 from lip Time: 9:33

Test Unit Fan Settings: Time:

TEST LOAD

	Lower Limit	Ideal	Upper Limit
Test Load Weight:	13.48 Lbs.	14.98 lbs.	16.48 Lbs.

Fire Box Volume:	2.14 Ft.^{3}	Ideal Length:	20 Inches
Load Volume:	0.4946 Ft.^{3}	Loading Density:	7.294 lbs/ft^3
Number of Spacers	16 ¾x1½x5	Load Density:	31.558 lbs/ft^3

Piece Size	Weight	Meter Moisture Content (% dry)*		
2 x 4 x 19 in.	2.57 lbs.	19.0 %	18.8 %	19.2 %
2 x 4 x 19 in.	2.49 lbs.	18.3 %	18.0 %	18.2 %
2 x 4 x 19 in.	2.85 lbs.	20.0 %	19.8 %	19.5 %
4 x 4 x 19 in.	3.98 lbs.	19.9 %	20.0 %	19.6 %
4 x 4 x 19 in.	3.72 lbs.	18.7 %	19.0 %	19.8 %
x x in.	lbs.	%	%	%
x x in.	lbs.	%	%	%

*Uncorrected range = 17.9% to 23.1%

TEST LOAD WEIGHT: 15.61 lbs. DRY WEIGHT: 5.88 kg.

AVERAGE MOISTURE CONTENT:

(DRY) 19.19 % CORRECTED TO TWO PIN: (DRY) 20.51 % (WET) 17.02 %

COAL BED RANGE: 3.2 lbs. to 3.9 lbs. (20% to 25% of test load)

TEST CHARGE:

Time loaded: 10:47 Coal bed weight: 3.3 lbs. Coal bed weight = 21.1 % of test load weight

CHARCOALIZATION: good |X|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-| por

ITS Intertek Testing Services

Manufacturer Morso Model 3600 Date 8-9-01

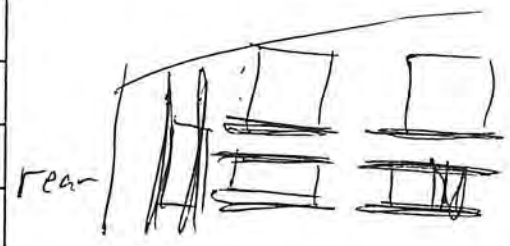
Job # J20049092 Run 4 Tech

COMMENTS

9:10 Partof preload added (6.0 lbs)

9:31 Restof preload added

TEST LOAD CONFIGURATION



Manufacturer Morso Model 3600 Date 8-9-01

Job # J20049092 Run 4 Tech

Air control 1/8 from lip

SWITCH NUMBER			1	2	3	4	5	6	7	8	9	10				
READING #	REAL TIME	ELAPSED TIME	WEIGHT REMAINING	FLUE GAS TEMP	ROOM TEMP	TUNNEL DRY BULB	TUNNEL WET BULB	UNIT TOP	UNIT BACK	UNIT RIGHT SIDE	UNIT LEFT SIDE	UNIT BOTTOM	CATALYST DOWNSTREAM	TUNNEL VELOCITY	DRAFT	SMOKE
0	9:34	0	13.6	549	76	164	71	457	101	161	185	124	642		.074	C
1		10	12.30	491	77	137	71	429	118	198	217	220	927	.040	.082	C
2		20	10.80	516	77	140	72	468	129	212	234	249	991		.082	C
3		30	9.20	611	79	155	74	523	140	227	265	270	1109	.040	.092	C
4		40	7.60	573	80	149	75	586	150	250	300	289	1070		.089	C
5		50	5.20	566	81	148	76	615	160	271	330	311	1073	.040	.089	C
6		60	4.70	506	84	142	78	602	171	293	354	339	906	.040	.081	C
7		70	3.30	431	84	129	78	528	178	307	365	377	769	.040	.072	C
8		80														
9		90														
10		100														
11		110														
12		120														
13		130														
14		140														
15		150														
16		160														
17		170														
18		180														
19		190														
20		200														
21		210														
22		220														
23		230														
24		240														
25		250														

Comments: 10:01 Fire stirred
10:26 Fire stirred 15sec
10:46 Fire stirred door open 1min

WHI LTO#: J200 47042 Air control 1 1/8 from each leg

MANUFACTURER: Marsa MODEL: 3600 FIRE SIZE: Med High DATE: 8/9/01 RUN#: 4 page 50 of 50

SWITCH NUMBER: TECHNICIAN:

READING#	REAL TIME	ELAPSED TIME	WEIGHT REMAIN	CO	CO_2	O_2	1 FLUE GAS TEMP	2 BOTTOM TEMP	3 TURNING TEMP	4 TURNING WET BULB	5 UNIT TOP	6 UNIT BACK	7 UNIT RT. SIDE	8 UNIT LEFT SIDE	9 UNIT BOTTOM	10 CAT EXIT	11 CAT CENTER	12	13	GAS SMPL ROTO.	DOAS #1 READING	ROTO 1 READING	17 DOAS TEMP INLET	18 DOAS TEMP OUTLET	19 FILTER TEMP	DOAS #2 READING	ROTO 2 READING	20 DOAS TEMP INLET	21 DOAS TEMP OUTLET	22 FILTER TEMP	FUNNEL VELOCITY	DRAFT	SMOKE	MAX DOAS PRESS
0	1047	0	15.61	.32	5.00	14.90	431	84	129	78	528	178	307	365	377	769				135	414.3	120	74	74	75	759.7	120	73	72	74	.040	.077	C	0
1		10	13.50	1.20	5.78	14.33	486	85	151	79	532	177	307	344	440	865				135	416.7	120	76	75	78	762.1	120	75	74	84	.040	.083	C	2
2		20	11.60	.18	10.80	9.37	601	85	159	79	530	173	300	324	437	1129				135	419.0	120	77	76	78	764.4	120	76	74	81	.040	.092	C	2
3		30	9.40	.50	14.26	5.87	688	87	173	80	650	172	302	331	428	1250				135	421.4	120	79	77	80	766.8	120	78	75	89	.039	.096	C	3
4		40	7.40	.43	12.19	7.94	636	88	165	82	698	177	320	356	421	1126				135	423.8	120	81	78	81	769.2	120	80	77	90	.040	.095	C	4
5		50	5.10	.23	10.98	9.19	594	89	160	83	684	183	337	378	418	1057				135	426.2	120	82	80	81	771.6	120	81	78	90	.040	.092	C	4
6		60	4.20	.13	9.39	10.67	554	90	151	83	657	189	350	391	422	951				135	428.6	120	84	82	82	774.0	120	82	80	90	.040	.089	C	4
7		70	3.50	.41	7.38	12.65	447	90	143	83	608	195	359	396	434	863				135	431.0	120	85	83	82	776.4	120	85	82	90	.040	.084	C	4
8		80	2.90	.25	6.19	13.63	451	89	134	83	557	197	360	392	450	754				135	433.4	120	85	84	82	778.8	120	86	83	90	.040	.079	C	4
9		90	2.60	.38	5.72	14.34	409	89	127	82	504	197	357	383	471	698				135	435.8	120	86	86	82	781.2	120	87	85	90	.040	.074	C	4
10		100	2.40	.46	5.66	14.45	390	89	124	82	466	196	350	371	490	668				135	438.2	120	87	86	83	783.6	120	88	87	90	.040	.071	C	4
11		110	2.10	.51	5.68	14.43	376	89	121	81	441	194	342	360	507	636				135	440.6	120	87	87	83	786.0	120	88	88	90	.040	.070	C	4
12		120	1.90	.62	5.36	14.68	368	89	120	82	420	192	335	353	515	621				135	443.0	120	88	88	84	788.4	120	88	88	90	.040	.069	C	4
13		130	1.50	.59	5.51	14.58	365	88	119	82	409	190	329	347	519	614				135	445.4	120	88	88	83	790.8	120	89	88	90	.040	.069	C	4
14		140	1.30	.70	5.24	14.76	358	88	117	81	399	188	325	341	524	597				135	447.8	120	88	88	84	793.2	120	89	89	90	.041	.068	C	4
15		150	1.10	.87	4.80	15.15	351	89	116	81	389	187	323	336	524	583				135	450.1	120	89	89	84	795.6	120	89	89	90	.041	.067	C	4
16		160	.80	1.01	4.71	15.13	344	88	116	82	380	186	319	332	522	576				135	452.5	120	89	89	86	798.0	120	88	89	90	.038	.066	C	4
17		170	.50	1.01	4.54	15.37	339	88	115	82	373	185	315	328	521	569				135	454.9	120	89	89	86	800.4	120	88	88	90	.040	.101.5	C	4
18		180	.30	1.02	4.15	15.73	330	88	113	82	364	183	310	322	520	550				135	457.4	120	88	89	86	802.8	120	87	88	90	.040	.064	C	4
19		190	.10	1.02	4.08	15.87	329	89	114	83	353	182	306	315	517	534				135	459.8	120	89	89	86	805.1	120	87	88	90	.040	.063	C	4
20	193	~~200~~	0.00	.94	3.95	16.03	320	89	113	82	351	181	305	313	515	530				135	460.6	120	88	89	86	805.9	120	87	87	90	.040	.062	C	4
21		210																																
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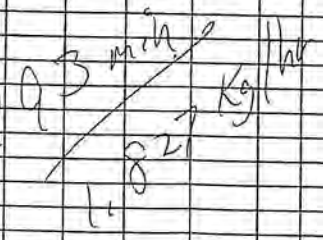


COMMENTS: doors open 90 sec

TEST LOADED IN 38 SECONDS air control full open 4½ min then slowly set to 1 7/8 at 5 min

APPENDIX B

INTRODUCTION

This document provides a step by step guide for the technician conducting tests to EPA standard requirements. Procedures outlined here, when followed, will result in tests in conformance with EPA Methods 28 and 5G-3. This guide cannot cover every possible contingency that may develop during a particular test program. Many questions that may arise can be answered by a complete understanding of the test standards and their intent. When in doubt on any detail check with the laboratory manager and be sure you understand the procedures involved.

The primary measurements to be obtained are particulate emission data and efficiency data. The technician's duties include the following steps. It is critical that all spaces on the data forms be properly filled in. Each test must be represented by a complete record of what was done and when.

I. APPLIANCE INSPECTION AND SET-UP
   - A. Incoming Inspection
   - B. Unit Set-Up

II. SAMPLING SYSTEMS - SET-UP
   - A. Gas Analysis
   - B. Dilution Tunnel

III. TEST CONDUCT
   - A. Pre-Test Fuel Load
   - B. Test Fuel Load
   - C. Unit Start - up
   - D. Test Run

IV. POST TEST PROCEDURE
   - A. Leak Checks
   - B. Particulate Sample Recovery

The technician running this test must be familiar with the following EPA documents that are to be kept in the laboratory at all times.

1. Method 28
2. Method 28A
3. Method 5G-3
4. Method 5H

I. APPLIANCE INSPECTION AND SET-UP

A. Incoming Inspection

1. Check for completeness of unit including parts, accessories, installation and operating instructions, drawings and specifications, etc. Note any discrepancies or missing parts.
2. Check for shipping damage. If damage has occurred, notify the laboratory manager. In some cases repairs may be made, provided the manufacturer and laboratory manager concur that repairs will not affect the units performance. If damage is irreparable, a new unit will need to be obtained.
3. Note whether unit is catalytic or non-catalytic.
4. Mark unit with manufacturer's name, model number, work order number and date received.
5. If unit is safety listed, note label data including listing agency and serial number.

B. Unit Set-Up

1. All units must be operated in-house for a break-in period as follows (the unit may be connected to a lab chimney). NOTE: Inserts are tested as if they are freestanding stoves.
   a. Non-catalytic units: 10 hours minimum burn time with a stack temperature of at least 250^0 Fahrenheit (medium burn rate, Douglas Fir scrap or cordwood.) A stack thermocouple must be installed and stack temperature recorded at 1-hour intervals or on chart recorder.
   b. Catalytic units: 50 hours minimum burn time with catalyst temperature in excess of 800^0 Fahrenheit (medium burn rate, Douglas Fir scraps or cordwood). Record catalyst temperature at 1-hour intervals or on chart recorder.
2. Once break-in is completed, allow unit to cool then clean unit thoroughly.
3. Thermocouples must be attached to surfaces of unit prior to testing. EPA requires a thermocouple on the outside bottom of the firebox. This must be installed prior to putting the unit on the scale. In some cases the required thermocouple locations will be inaccessible on finished units. Check with the laboratory manager if problems are encountered in proper thermocouple attachment.
4. Prior to placing unit on scale, the scale must be turned on and allowed to warm up for 1-hour minimum.
5. Place unit on scale and align so chimney will be centered in hood. Record the weight of the unit and all accessories. (Do not weight with chimney attached.)

6. Chimney and connector should be cleaned with a wire brush prior to mounting. Attach chimney and connector then seal all joints. Be sure single wall stove pipe terminates and insulated pipe starts at proper level above scale platform. Chimney must be supported from scale so that it does not touch test enclosure or hood walls.
7. Measure firebox dimensions and record on appropriate data form. Make a three dimensional sketch of the firebox including firebrick, baffles, and obstructions. Calculate firebox volume in cubic feet. See Section 6.2.4 of EPA Method 28 for details.
8. If unit is equipped with a catalyst additional thermocouples must be installed downstream of, and inside catalyst (upstream optional).
9. Plug thermocouples into data acquisition system jacks and verify that all instrumentation is working properly.
10. Dilution tunnel must be cleaned prior to each certification test series, and at anytime a higher burn rate follows a lower burn rate.

II. SAMPLING SYSTEMS SET-UP

A. Gas Analysis

1. All instruments should be turned on and allowed to warm up for 1-hour minimum.
2. Prior to calibrating, make sure that the outlet pressure on each calibration gas bottle reads 10 PSI. Adjust flow meters at each gas analyzer to required flow.

All gas analyzers (CO_2, CO, O_2) are zeroed on nitrogen. The O_2 analyzer is spanned on air and set for 20.93%. CO_2 and CO analyzers are spanned with their respective gases.

Calibrate analyzers as follows:

a. With calibration switch at "SPAN", adjust all span controls to values specified on span gas label.
b. Switch to "ZERO" and adjust zero controls to provide 0.00 readout on all analyzers.
c. Repeat a. and b. until no further adjustment is required.
d. Record these values on the appropriate data sheet.
e. Switch to "CAL." and record all analyzer values.

3. Response time synchronization check.

a. With switch at "SAMPLE" and no fire in unit, allow readings to stabilize (O_2 analyzer should read 20.93, CO and CO_2 should read 0.00).
b. Switch to "CAL" setting and start the stopwatch. Note the time required for each unit to reach the calibration gas bottle value. If all three analyzers reach this value within 5 seconds of each other, synchronization is adequate. If not, contact the laboratory manager. Synchronization is adjusted by either internal instrument setting or adjustment of sample line length.
c. Use EPA Method 5H 6.7-6.9 procedures to check calibration of instruments.

4. Sample clean-up train.

   a. Load a new filter in 4-inch glass filter holder.
   b. Load four Impingers as follows:
      #1: 100 ml. distilled water and 5 ml. H_2SO_4
      #2: 100 ml. distilled water and 5 ml. H_2SO_4
      #3: Empty
      #4: 200-300 grams Drierite.

   c. Place Impingers in container and connect with greased "U TUBES". (Grease carefully on bottom half of ball joint so that grease will not get into tubes.)
   d. Connect filter to impinger #1 and sample line to impinger #4.
   e. Connect stack probe to filter.
   f. Leak check system as follows:
      1) Plug probe.
      2) Turn on sample system and increase flow rate slowly.
      3) Set vacuum adjust valve to obtain a vacuum of 10 inches mercury.
      4) If sapphire float in rotometer does not stabilize below 10 on scale, system must be resealed.
      5) Repeat leak check procedure until satisfactory results are obtained.
      6) Unplug probe slowly, then decrease flow rate slowly before shutting off system.

   g. Just prior to starting test, fill impinger container with ice.

B. Dilution Tunnel Sample Train Set-Up:

1. Filters and holders.

   a. Clean probes and filter holder front housings carefully and desiccate to a constant weight prior to use.
   b. Filters and filter probe combinations should be numbered and labeled prior to use.
   c. Weigh desiccated filters and probe filter units on analytical balance. Record weights on appropriate form. Note that probe and front half of front filter holder is to be weighed as a unit.
   d. Carefully assemble filter holder units and connect to sampling systems.
   e. Check Silica gel columns for adequate dry absorbent (blue color).

2. Leak checking.

   a. Each sample system is to be checked for leakage prior to inserting probes in tunnel.
   b. Plug probes and start samplers. Adjust pump bypass valve to produce a vacuum reading of 10 inches mercury. NOTE: During test, highest vacuum recorded is required for posttest leak check.
   c. Allow vacuum indication to stabilize at 10" mercury, record dry gas meter readings, (DGM_1, DGM_2). At a convenient DGM value start stopwatch. Time for 1 minute then stop vacuum pumps. Record dry gas meter readings again, (DGM_3, DGM_4). NOTE: If rotometer ball is floating above the 5-mm mark, system is leaking too much and all seals should be checked.
   d. Calculate leakage rate as follows.

      System 1: $DGM_3-DGM_1 = CFM_1$
      System 2: $DGM_4-DGM_2 = CFM_2$

      If CFM_1 or CFM_2 is greater than 0.02 cfm, or $_1S$ greater than 0.04 x Sample Rate, leakage is unacceptable and system must be resealed. For most tests the sample rate will be 0.25 cfm, thus leakage rates in excess of 0.04 x 0.25 = 0.010 cfm are not acceptable.
   e. To prevent contamination, do not insert probes in tunnel until the start of the test run.

III. TEST CONDUCT

A. Pre-Test Fuel Load

1. Using 2x4 Douglas Fir cut enough pieces to approximate test load weight. (Piece length must be greater than 1/3 of the test load length.)
2. Measure percent moisture content using Delmhorst moisture meter. The average percent moisture must be within 19 to 25 percent.

B. Test Fuel Load

1. Determine optimum load weight by multiplying firebox volume (cubic feet) by 7. This is the ideal load weight.
2. Determine piece size mix i.e. <1.5 cubic feet volume use 2x4's only; 1.5 ft^3 to 3.0 ft^3 use a mix of 2.4's and 4x4's; >3.0 ft_3 use only 4x4's. Ideal length is 5/6 of the longest firebox dimension.
3. Weigh out test load and appropriate number of spacers and adjust weight by shortening or lengthening all pieces equally if necessary.
4. Construct test loads by attaching spacers as shown in EPA Method 28.
5. Measure and record moisture content of each fuel piece (use three sides). Determine if fuel load moisture content is within required range (19-25%). If not, construct new fuel pieces using wood with required moisture content. All wood in the humidity chamber is Douglas Fir and should be within range. Contact laboratory manager if you cannot find suitable pieces.

C. Unit Start-Up

1. With all doors and air controls closed, zero draft Magnehelic using screw located at bottom of meter.
2. Before lighting a fire, turn on dilution tunnel and set flow rate to 140 scfm (approximately 715 fpm) if burn rate is to be less than 3 kg/hr. For higher burn rates set flow for a 150:1 air fuel ratio (see chart for approximate values).
3. Check draft imposed on cold stove. All inlets must be closed and a draft gauge in the chimney. If draft is greater than 0.005 inches water column, adjust tunnel to stack gap until draft is less than 0.005 inches water column.
4. With hot wire anemometer check for ambient airflow around unit (must be less than 50 ft/min).
5. Zero scale and start fire with newspaper and Douglas Fir kindling. (Make sure stack sample probe is on the unit.)

6. Once kindling is burning well, add preload fuel. Operate at high fire for sufficient time to get fuel load burning well. Then adjust settings to intended test run levels.
7. Perform the dilution tunnel traverse as prescribed in Method 28, Section 6.3. (Pitot tube should be carefully cleaned prior to each test.)
8. Pretest load must burn for a minimum of 1 hour. Record stove surface, catalyst, room and flue temperatures.
9. Stir fire often during preburn (after a reading) to get a good coal bed. Fire can only be raked once (door open 1 minute or less) during the 15 minutes prior to the start of the test.

D. Test Run

1. Stack gas analyzers should be on and in the sample mode.
2. When the fuel bed is between 20-25% of the test load weight the test is to be started.

   a. Insert the sample probes into the tunnel being careful not to hit sides of tunnel with probe tip.
   b. Check tunnel Pitot tube for proper position.
   c. Record initial readings.
   d. Turn on probe sample systems and start timing test.
   e. Tare platform scale.
   f. Open stove doors and load stove. Close door or follow manufacturer's start-up procedures. Five minutes is the maximum time before all doors and controls must be set to final positions for duration of test.
   g. Record length of time door and bypass are open, include any air control setting adjustments.
   h. Every 10 minutes record the following:

      1) Dry gas meter readings.
      2) Weight remaining.
      3) All thermocouple temperatures.
      4) Tunnel Pitot tube reading.
      5) Draft reading.
      6) Rotometer readings.

   i. Filter temperatures shall not exceed 901F anytime during the test. If approaching 901F turn on cooling pump. Filters must be kept above the dilution tunnel wet bulb temperature in order to prevent condensation.
   j. Regularly check impinger for ice level during test.
   k. After 30 seconds of 0.00 lbs. weight, and on the minute, shut off sample trains and record last reading.
   l. Record final dry gas meter values.

IV. POST TEST PROCEDURES

A. Leak Checks

1. Dilution Tunnel

   a. Remove both sample probes from tunnel and plug with rubber stopper.
   b. Turn on sample system and set vacuum to 10" mercury or to the highest value reached during the test.
   c. At a convenient value start stop watch. Record DGM starting value.
   d. After 1 minute stop sample system and record ending DGM value.
   e. Calculate leakage rate per pre-test description (see II.B.2.c.).

2. Gas Analyzers

   a. Set stack sample flow to about 75 mm on the rotometer.
   b. Plug with rubber stopper.
   c. Adjust vacuum to 10" mercury.
   d. Let system stabilize then record rotometer readings.
   e. If rotometer readings do not equal zero check with laboratory manager.
   f. SLOWLY unplug probe and decrease flow rate to zero.
   g. Turn off stack sampling system.
   h. Zero, span and calibrate the analyzers (see Gas Analysis). RECORD ONLY these meter values.

B. Particulate Sample Recovery

1. Disassemble filter holder and scrape gasket with scalpel. Collect all loose material on filters.
2. Weigh and record probes and filters for each train. NOTE: 24 hours of desiccation must pass before final "no change" weight values can be recorded.
3. Weigh and record probes and fillers at 2-hour intervals until weight change between weighing is less than 0.5 mg.

V. DISPOSITION OF TESTED UNIT.

In order to meet the requirements of section 60.535(g) of the EPA's 40CFR Part 60 Standards of Performance for New Stationary Sources; New Residential Wood Heaters, Intertek Testing Services seals certified wood heaters by strapping the unit to a pallet and covering the unit with stretch wrap. A copy of the EPA certificate is attached and our WHI logo stamped on the stretch wrap in various positions and then another layer of stretch wrap is used to cover the markings and copy of the certificate. Any breaking of the stretch wrap seal will be easily noticeable. The unit is then shipped back to the manufacturer.

APPENDIX C

		Manufacturer:		Morso					
		Model:		3600					
		Date:		8/6/01					
		Run:		1					
		Project #:		J20049092					
		Test Duration:		270					
	Total Gas Volume (DGM 1):			62.32975					
	Total Gas Volume (DGM 2):			63.03275					
	Average Barometric Pressure:			29.3					
		Molecular Weight:		28.56					
		Pitot Correction:		0.9824					
	Calibration Factor (DGM #1):			1.0206					
	Calibration Factor (DGM #2):			1.0311					
			(1) VS:	0.023272					
			(2) VS:	0.023013				Filter	Filter
								Face	Face
Elapsed	DGM 1	DGM 1	DGM 1	DGM 2	DGM 2	DGM 2	Tunnel	Velocity	Velocity
Time	Reading	Inlet T	Outlet T	Reading	Inlet T	Outlet T	Dry Bulb	DGM 1	DGM 2
0	240.1	79	78	586.4	76	76	108		
10	242.5	79	78	588.7	77	76	128	20.27	19.70
20	244.9	80	79	591.1	79	77	127	20.23	20.49
30	247.2	81	80	593.5	79	78	128	19.35	20.48
40	249.6	82	81	595.9	81	79	129	20.15	20.42
50	252.0	83	82	598.2	82	80	126	20.12	19.53
60	254.4	84	83	600.6	83	81	120	20.08	20.34
70	256.8	85	84	603.0	84	82	114	20.04	20.31
80	259.1	86	85	605.3	85	84	110	19.17	19.41
90	261.5	86	86	607.7	85	83	108	19.99	20.27
100	263.9	87	87	610.1	86	85	106	19.95	20.21
110	266.3	88	88	612.5	87	85	105	19.92	20.19
120	268.7	88	88	614.9	87	86	102	19.92	20.18
130	271.1	88	88	617.3	87	86	101	19.92	20.18
140	273.5	89	89	619.7	88	87	101	19.88	20.14
150	275.9	89	90	622.1	88	87	99	19.86	20.14
160	278.3	90	90	624.5	88	88	99	19.84	20.12
170	280.7	90	90	626.9	88	88	99	19.84	20.12
180	283.1	89	90	629.3	88	88	98	19.86	20.12
190	285.5	89	90	631.7	88	89	98	19.86	20.10
200	287.9	89	90	634.1	88	88	98	19.86	20.12
210	290.3	89	90	636.5	88	88	97	19.86	20.12
220	292.7	89	89	638.9	88	89	97	19.88	20.10
230	295.1	88	89	641.3	88	88	97	19.90	20.12
240	297.5	88	88	643.7	88	88	97	19.92	20.12
250	299.9	89	89	646.1	88	88	97	19.88	20.12
260	302.3	89	89	648.5	88	88	97	19.88	20.12
270	304.7	88	89	650.9	88	88	96	19.90	20.12

	Proportional Rate Calculations				(EPA Formulas from PR5G)			
	Stack area (ft2):	0.1963			Manufacturer:		Morso	
	Wood moisture (% wet):	17.36			Model:		3600	
	Load Weight (lbs wet):	14.87			Date:		8/6/01	
	Burn Rate (Dry kg/hr):	1.239			Run:		1	
Final Temperature (DGM #1) Degrees Rankin:					546.429			
Final Temperature (DGM #2) Degrees Rankin:					545.000			
Final Tunnel Temperature Degrees Rankin:					566.500			
Final Tunnel Velocity (feet per second):					13.6957793			
Standardized Tunnel Flow (dscfm):					141.284923			

Tunnel Velocity	Tunnel Velocity Ft/Sec	Average Inlet + Outlet Temp. Meter 1 Deg. R	Average Inlet + Outlet Temp. Meter 2 Deg. R	PR1	PR2	#1 dDGM Vol.Std. (ft3)	#2 dDGM Vol.Std. (ft3)	Time
0.040	13.703	538.5	536.0					0
0.040	13.942	538.5	536.5	103.84	99.78	2.351	2.285	10
0.039	13.755	539.5	538.0	104.88	105.07	2.347	2.377	20
0.040	13.942	540.5	538.5	99.14	103.74	2.245	2.375	30
0.040	13.954	541.5	540.0	103.35	103.54	2.338	2.369	40
0.040	13.918	542.5	541.0	102.90	98.79	2.334	2.266	50
0.040	13.847	543.5	542.0	102.18	102.36	2.329	2.360	60
0.040	13.775	544.5	543.0	101.46	101.64	2.325	2.355	70
0.040	13.727	545.5	544.5	96.72	96.80	2.224	2.251	80
0.040	13.703	546.0	544.0	100.65	100.93	2.319	2.351	90
0.041	13.849	547.0	545.5	99.06	99.24	2.314	2.345	100
0.040	13.667	548.0	546.0	100.02	100.29	2.310	2.343	110
0.040	13.630	548.0	546.5	99.76	99.93	2.310	2.340	120
0.040	13.618	548.0	546.5	99.67	99.84	2.310	2.340	130
0.040	13.618	549.0	547.5	99.49	99.66	2.306	2.336	140
0.040	13.594	549.5	547.5	99.22	99.48	2.304	2.336	150
0.039	13.423	550.0	548.0	100.39	100.66	2.302	2.334	160
0.040	13.594	550.0	548.0	99.13	99.39	2.302	2.334	170
0.040	13.582	549.5	548.0	99.13	99.30	2.304	2.334	180
0.040	13.582	549.5	548.5	99.13	99.21	2.304	2.332	190
0.041	13.750	549.5	548.0	97.91	98.08	2.304	2.334	200
0.040	13.569	549.5	548.0	99.04	99.21	2.304	2.334	210
0.040	13.569	549.0	548.5	99.13	99.12	2.306	2.332	220
0.041	13.738	548.5	548.0	98.00	98.00	2.308	2.334	230
0.040	13.569	548.0	548.0	99.31	99.21	2.310	2.334	240
0.041	13.738	549.0	548.0	97.91	98.00	2.306	2.334	250
0.040	13.569	549.0	548.0	99.13	99.21	2.306	2.334	260
0.040	13.557	548.5	548.0	99.13	99.13	2.308	2.334	270

Manufacturer:	Morso
Model:	3600
Date:	8/8/01
Run:	2
Project #:	J20049092
Test Duration:	370
Total Gas Volume (DGM 1):	85.475451
Total Gas Volume (DGM 2):	86.303969
Average Barometric Pressure:	29.27
Molecular Weight:	28.56
Pitot Correction:	0.9794
Calibration Factor (DGM #1):	1.0206
Calibration Factor (DGM #2):	1.0311
(1) VS:	0.0164913
(2) VS:	0.016333

Elapsed Time	DGM 1 Reading	DGM 1 Inlet T	DGM 1 Outlet T	DGM 2 Reading	DGM 2 Inlet T	DGM 2 Outlet T	Tunnel Dry Bulb	Filter Face Velocity DGM 1	Filter Face Velocity DGM 2
0	305.0	79	79	650.9	77	77	106		
10	307.4	81	79	653.3	79	78	125	20.19	20.45
20	309.8	82	80	655.7	80	78	124	20.15	20.44
30	312.1	83	81	658.1	82	80	128	19.28	20.36
40	314.5	84	83	660.5	82	80	129	20.06	20.36
50	316.9	84	83	662.9	83	82	130	20.06	20.30
60	319.3	85	84	665.3	84	83	128	20.02	20.27
70	321.7	86	85	667.7	85	84	122	19.99	20.23
80	324.0	87	86	670.1	86	84	118	19.12	20.21
90	326.4	88	87	672.5	87	86	115	19.91	20.16
100	328.8	87	87	674.9	86	86	110	19.93	20.17
110	331.2	86	86	677.3	87	87	108	19.97	20.14
120	333.6	86	86	679.6	87	88	106	19.97	19.28
130	336.0	86	86	682.0	88	88	104	19.97	20.10
140	338.4	86	86	684.4	88	88	103	19.97	20.10
150	340.8	87	87	686.8	88	89	102	19.93	20.08
160	343.2	87	87	689.2	87	88	101	19.93	20.12
170	345.6	87	87	691.6	87	88	101	19.93	20.12
180	347.9	86	87	693.9	86	87	100	19.12	19.32
190	350.3	86	87	696.3	86	87	100	19.95	20.16
200	352.7	86	87	698.7	85	87	100	19.95	20.17
210	355.1	86	86	701.0	85	86	100	19.97	19.35
220	357.5	86	86	703.4	85	85	99	19.97	20.21
230	359.9	86	86	705.8	85	86	99	19.97	20.19
240	362.3	86	86	708.2	86	86	100	19.97	20.17
250	364.7	86	86	710.6	85	85	99	19.97	20.21
260	367.1	86	86	713.0	85	85	99	19.97	20.21
270	369.5	86	86	715.4	85	86	98	19.97	20.19
280	372.0	86	86	717.8	85	86	98	20.80	20.19
290	374.4	85	86	720.2	86	86	97	19.99	20.17
300	376.8	86	86	722.6	86	87	97	19.97	20.16
310	379.2	86	86	725.0	86	86	97	19.97	20.17
320	381.6	86	86	727.4	86	86	96	19.97	20.17
330	383.9	86	86	729.7	86	86	96	19.14	19.33
340	386.3	86	86	732.1	86	86	96	19.97	20.17
350	388.7	86	86	734.5	86	86	96	19.97	20.17
360	391.1	86	86	736.9	85	85	97	19.97	20.21
370	393.5	87	86	739.3	86	86	96	19.95	20.17

Proportional Rate Calculations					(EPA Formulas from PR5G)			
Stack area (ft2):		0.1963			Manufacturer:		Morso	
Wood moisture (% wet):		16.96			Model:		3600	
Load Weight (lbs wet):		15.54			Date:		8/8/01	
Burn Rate (Dry kg/hr):		0.949			Run:		2	
Final Temperature (DGM #1) Degrees Rankin:					545.434			
Final Temperature (DGM #2) Degrees Rankin:					545.105			
Final Tunnel Temperature Degrees Rankin:					565.789			
Final Tunnel Velocity (feet per second):					13.2923224			
Standardized Tunnel Flow (dscfm):					137.154509			
		Average Inlet + Outlet Temp. Meter 1	Average Inlet + Outlet Temp. Meter 2			#1 dDGM Vol.Std.	#2 dDGM Vol.Std.	
Tunnel Velocity	Tunnel Velocity Ft/Sec	Deg. R	Deg. R	PR1	PR2	(ft3)	(ft3)	Time
0.040	13.641	539.0	537.0					0
0.039	13.694	540.0	538.5	101.75	102.09	2.342	2.373	10
0.039	13.682	541.0	539.0	101.47	101.91	2.338	2.371	20
0.038	13.552	542.0	541.0	98.67	103.21	2.236	2.362	30
0.038	13.563	543.5	541.0	102.76	103.30	2.327	2.362	40
0.038	13.575	543.5	542.5	102.85	103.10	2.327	2.355	50
0.038	13.552	544.5	543.5	102.49	102.74	2.323	2.351	60
0.038	13.483	545.5	544.5	101.78	102.02	2.318	2.347	70
0.038	13.436	546.5	545.0	97.02	101.58	2.218	2.344	80
0.039	13.576	547.5	546.5	99.49	99.73	2.310	2.338	90
0.040	13.689	547.0	546.0	97.90	98.14	2.312	2.340	100
0.039	13.494	546.0	547.0	99.16	99.03	2.316	2.336	110
0.039	13.470	546.0	547.5	98.98	94.65	2.316	2.236	120
0.038	13.272	546.0	548.0	100.10	99.79	2.316	2.332	130
0.039	13.434	546.0	548.0	98.72	98.42	2.316	2.332	140
0.039	13.422	547.0	548.5	98.45	98.24	2.312	2.329	150
0.038	13.237	547.0	547.5	99.65	99.62	2.312	2.334	160
0.039	13.410	547.0	547.5	98.36	98.33	2.312	2.334	170
0.039	13.398	546.5	546.5	94.27	94.32	2.218	2.241	180
0.038	13.225	546.5	546.5	99.65	99.71	2.314	2.338	190
0.037	13.050	546.5	546.0	100.99	101.14	2.314	2.340	200
0.038	13.225	546.0	545.5	99.74	95.73	2.316	2.245	210
0.039	13.386	546.0	545.0	98.37	98.61	2.316	2.344	220
0.038	13.213	546.0	545.5	99.65	99.80	2.316	2.342	230
0.038	13.225	546.0	546.0	99.74	99.80	2.316	2.340	240
0.036	12.861	546.0	545.0	102.38	102.63	2.316	2.344	250
0.036	12.861	546.0	545.0	102.38	102.63	2.316	2.344	260
0.037	13.027	546.0	545.5	100.90	101.05	2.316	2.342	270
0.037	13.027	546.0	545.5	105.11	101.05	2.413	2.342	280
0.037	13.015	545.5	546.0	100.90	100.87	2.318	2.340	290
0.037	13.015	546.0	546.5	100.81	100.78	2.316	2.338	300
0.037	13.015	546.0	546.0	100.81	100.87	2.316	2.340	310
0.038	13.178	546.0	546.0	99.39	99.45	2.316	2.340	320
0.037	13.003	546.0	546.0	96.52	96.58	2.220	2.243	330
0.036	12.827	546.0	546.0	102.11	102.17	2.316	2.340	340
0.038	13.178	546.0	546.0	99.39	99.45	2.316	2.340	350
0.038	13.190	546.0	545.0	99.48	99.72	2.316	2.344	360
0.037	13.003	546.5	546.0	100.63	100.78	2.314	2.340	370

		Manufacturer:		MORSO					
		Model:		3600					
		Date:		8/8/01					
		Run:		3					
		Project #:		0					
		Test Duration:		85					
	Total Gas Volume (DGM 1):			19.615629					
	Total Gas Volume (DGM 2):			19.68314					
	Average Barometric Pressure:			29.035					
		Molecular Weight:		28.56					
		Pitot Correction:		0.9837					
	Calibration Factor (DGM #1):			1.0206					
	Calibration Factor (DGM #2):			1.0311					
			(1) VS:	0.0777721					
			(2) VS:	0.0775054				Filter	Filter
								Face	Face
Elapsed	DGM 1	DGM 1	DGM 1	DGM 2	DGM 2	DGM 2	Tunnel	Velocity	Velocity
Time	Reading	Inlet T	Outlet T	Reading	Inlet T	Outlet T	Dry Bulb	DGM 1	DGM 2
0	393.6	78	78	739.3	76	76	185		
10	396.0	80	78	741.7	78	76	266	20.07	20.35
20	398.4	81	79	744.0	79	77	258	20.03	19.46
30	400.8	82	81	746.4	81	78	237	19.97	20.25
40	403.2	84	82	748.7	83	80	210	19.92	19.34
50	405.6	85	83	751.1	84	81	190	19.88	20.14
60	408.0	86	85	753.5	85	83	178	19.83	20.09
70	410.4	87	86	755.9	86	84	168	19.79	20.05
80	412.8	88	87	758.3	87	85	161	19.75	20.01
85	414.0	88	88	759.5	87	86	158	19.74	19.99

	Proportional Rate Calculations				(EPA Formulas from PR5G)			
	Stack area (ft2):	0.1963			Manufacturer:		MORSO	
	Wood moisture (% wet):	18.32			Model:		3600	
	Load Weight (lbs wet):	15.69			Date:		8/8/01	
	Burn Rate (Dry kg/hr):	4.103			Run:		3	
	Final Temperature (DGM #1) Degrees Rankin:				543.300			
	Final Temperature (DGM #2) Degrees Rankin:				541.600			
	Final Tunnel Temperature Degrees Rankin:				661.100			
	Final Tunnel Velocity (feet per second):				16.8090142			
	Standardized Tunnel Flow (dscfm):				147.244229			

Tunnel Velocity	Tunnel Velocity Ft/Sec	Average Inlet + Outlet Temp. Meter 1 Deg. R	Average Inlet + Outlet Temp. Meter 2 Deg. R	PR1	PR2	#1 dDGM Vol.Std. (ft3)	#2 dDGM Vol.Std. (ft3)	Time
0.052	16.744	538.0	536.0					0
0.050	17.419	539.0	537.0	106.88	108.01	2.328	2.360	10
0.049	17.149	540.0	538.0	107.17	103.79	2.323	2.258	20
0.050	17.068	541.5	539.5	104.24	105.34	2.317	2.349	30
0.052	17.065	543.0	541.5	99.94	96.70	2.310	2.243	40
0.053	16.969	544.0	542.5	97.33	98.26	2.306	2.336	50
0.053	16.812	545.5	544.0	96.16	97.08	2.300	2.330	60
0.051	16.362	546.5	545.0	97.08	98.01	2.296	2.326	70
0.051	16.271	547.5	546.0	96.36	97.28	2.291	2.321	80
0.051	16.231	548.0	546.5	96.04	96.96	1.145	1.160	85

		Manufacturer:		Morso					
		Model:		3600					
		Date:		8/9/01					
		Run:		4					
		Project #:		J20049092					
		Test Duration:		193					
	Total Gas Volume (DGM 1):			44.341478					
	Total Gas Volume (DGM 2):			44.744423					
	Average Barometric Pressure:			28.98					
		Molecular Weight:		28.56					
		Pitot Correction:		0.9794					
	Calibration Factor (DGM #1):			1.0206					
	Calibration Factor (DGM #2):			1.0311					
			(1) VS:	0.0320172					
			(2) VS:	0.0317289				Filter Face	Filter Face
Elapsed Time	DGM 1 Reading	DGM 1 Inlet T	DGM 1 Outlet T	DGM 2 Reading	DGM 2 Inlet T	DGM 2 Outlet T	Tunnel Dry Bulb	Velocity DGM 1	Velocity DGM 2
0	414.3	74	74	759.7	73	72	129		
10	416.7	76	75	762.1	75	74	151	20.16	20.40
20	419.0	77	76	764.4	76	74	159	19.28	19.54
30	421.4	79	77	766.8	78	75	173	20.06	20.33
40	423.8	81	78	769.2	80	77	165	20.01	20.25
50	426.2	82	80	771.6	81	78	160	19.95	20.21
60	428.6	84	82	774.0	82	80	151	19.88	20.16
70	431.0	85	83	776.4	85	82	143	19.84	20.07
80	433.4	85	84	778.8	86	83	134	19.82	20.03
90	435.8	86	86	781.2	87	85	127	19.77	19.97
100	438.2	87	86	783.6	88	87	124	19.75	19.92
110	440.6	87	87	786.0	88	88	121	19.73	19.90
120	443.0	88	88	788.4	88	88	120	19.70	19.90
130	445.4	88	88	790.8	89	88	119	19.70	19.88
140	447.8	88	88	793.2	89	89	117	19.70	19.86
150	450.1	89	89	795.6	89	89	116	18.84	19.86
160	452.5	89	89	798.0	88	89	116	19.66	19.88
170	454.9	89	89	800.4	88	88	115	19.66	19.90
180	457.4	88	89	802.8	87	88	113	20.50	19.92
190	459.8	89	89	805.1	87	88	114	19.66	19.09
193	460.6	88	89	805.9	87	87	113	21.87	22.15

Proportional Rate Calculations

Stack area (ft

(EPA Formulas from PR5G)

	0.1963	Manufacturer:	Morso
W ..d moisture (% wet):	17.02	Model:	3600
Load Weight (lbs wet):	15.61	Date:	8/9/01
Burn Rate (Dry kg/hr):	1.827	Run:	4

Final Temperature (DGM #1) Degrees Rankin:	544.405
Final Temperature (DGM #2) Degrees Rankin:	543.810
Final Tunnel Temperature Degrees Rankin:	592.381
Final Tunnel Velocity (feet per second):	14.0166304
Standardized Tunnel Flow (dscfm):	136.767302

Tunnel Velocity	Tunnel Velocity Ft/Sec	Average Inlet + Outlet Temp. Meter 1 Deg. R	Average Inlet + Outlet Temp. Meter 2 Deg. R	PR1	PR2	#1 dDGM Vol.Std. (ft3)	#2 dDGM Vol.Std. (ft3)	Time
0.040	13.987	534.0	532.5					0
0.040	14.246	535.5	534.5	103.28	103.60	2.338	2.367	10
0.040	14.339	536.5	535.0	99.44	99.84	2.237	2.266	20
0.039	14.318	538.0	536.5	105.97	106.40	2.327	2.358	30
0.040	14.408	539.5	538.5	103.69	104.00	2.321	2.349	40
0.040	14.351	541.0	539.5	102.99	103.39	2.315	2.345	50
0.040	14.246	543.0	541.0	101.86	102.36	2.306	2.338	60
0.040	14.153	544.0	543.5	101.00	101.22	2.302	2.328	70
0.040	14.047	544.5	544.5	100.15	100.27	2.300	2.323	80
0.040	13.964	546.0	546.0	99.29	99.41	2.293	2.317	90
0.040	13.928	546.5	547.5	98.94	98.88	2.291	2.311	100
0.040	13.892	547.0	548.0	98.60	98.54	2.289	2.308	110
0.040	13.880	548.0	548.0	98.34	98.45	2.285	2.308	120
0.040	13.868	548.0	548.5	98.25	98.28	2.285	2.306	130
0.041	14.016	548.0	549.0	96.88	96.82	2.285	2.304	140
0.041	14.004	549.0	549.0	92.59	96.73	2.186	2.304	150
0.038	13.482	549.0	548.5	100.36	100.57	2.281	2.306	160
0.040	13.820	549.0	548.0	97.73	98.03	2.281	2.308	170
0.040	13.796	548.5	547.5	101.72	97.95	2.378	2.311	180
0.040	13.808	549.0	547.5	97.65	93.95	2.281	2.214	190
0.040	13.796	548.5	547.0	108.50	108.93	0.761	0.771	193

APPENDIX D

Intertek Testing Services

Warnock Hersey

Middleton, Wisconsin

Post Test Dry Gas Meter Calibration Data

Manufacturer: Morso Model: 3600 Job Number: J20049092 Date: 8/13/01 Tech: WK

Barometric Press: 29.13 Calibration Factors: DGM#1: 1.0206 DGM#2: 1.0311 Std.Meter DGM#3: 1.0523

Trial No.	Std Meter # 3 Press Drop	Initial Ft.^{3}	Final Ft^3	Change Ft.^{3}	Temp °F	Std. Ft^3	System # 1 Initial Ft.^{3}	Final Ft.^{3}	Change Ft.^{3}	Temp °F	Std Ft.^{3}	Cal Factor
1	1.6	586.769	589.12	2.3510	70	2.3995	471.938	474.365	2.4270	73	2.3890	1.0044
2	1.6	589.12	591.479	2.3590	70	2.4077	474.365	476.808	2.4430	73	2.4047	1.0012
3	1.6	591.479	593.821	2.3420	70	2.3904	476.808	479.228	2.4200	73.5	2.3798	1.0044
											Average:	1.0034

Previous Cal Factor:	Minus -	Avg. Cal. Factor	divided by /	Previous Cal Factor	Times 100 *	equals =	Precent Deviation
1.0206		1.0034		1.0206			1.6890

Trial No.	Std Meter #3 Press Drop	Initial Ft.^{3}	Final Ft^3	Change Ft.^{3}	Temp °F	Std. Ft^3	System # 2 Initial Ft.^{3}	Final Ft.^{3}	Change Ft.^{3}	Temp °F	Std Ft.^{3}	Cal Factor
1	1.6	579.466	581.835	2.3690	69.5	2.4202	810.118	812.539	2.4210	71	2.4167	1.0015
2	1.6	581.835	584.253	2.4180	70	2.4679	812.539	815.009	2.4700	71	2.4656	1.0010
3	1.6	584.253	586.643	2.3900	70	2.4394	815.009	817.456	2.4470	71.5	2.4403	0.9996
											Average:	1.0007

Previous Cal Factor:	Minus -	Avg. Cal. Factor	divided by /	Previous Cal Factor	Times 100 *	equals =	Precent Deviation
1.0311		1.000679		1.0311			2.95030

APPENDIX E

Manufacturer: Morso
Project No:- J20049092, 3005306
Model: 3600
Date: 08/13/01

	CO		CO2		O2	
	Actual	Should be	Actual	Should be	Actual	Should be
Zero Gas	0	0	0	0	0	0
Span Gas	9.96	9.96	24.65	24.65	20.93	20.93
Cal GAS #1	0.94	0.99	9.66	9.99	10.24	10.2
Deviation		5.05%		3.30%		0.39%
Cal GAS #2	2.48	2.489	5.83	6.086	5.39	5.2
Deviation		0.36%		4.21%		3.65%
Cal GAS #3	7.74	7.68	19.37	19.86	17.44	17.16
Deviation		0.78%		2.47%		1.63%
Average Deviation		2.06%		3.33%		1.89%

Gasanaly/p

EQUIPMENT	MANUFACTURER	MODEL	INVEN #	MEASUREMENT UNCERTAINTY
CO analyzer	Horiba	PIR 2000	9	± 5 ppm, 95% CL
CO_2 analyzer	Horiba	PIR 2000	10	± 0.5%, 95% CL
O_2 analyzer	Beckman	755R	11	± 0.5%, 95% CL
Dry gas meter	Rockwell	T-110	12	± 0.1 ft^3/hr, 95% CL
Dry gas meter	Rockwell	T-110	13	± 0.1 ft^3/hr, 95% CL
Anemometer	Davis	1800	442	± 2 % of reading
Manometer Inclined 0-1 inch	Dwyer	125-AV	22	± 0.01-in
Manometer Inclined 0-10inch	Dwyer	400	24	±0.02"
Barometer 35" Mercury	Princo	Nova 469	437	.01"
Magnehelic (draft indicator)	Dwyer	2000-00C	554	±2% of FS = 0.005"
Scale	Toledo Masstron	ML222	25	±0.1 lbs.
Readout	WeighTronix	WI110	259	±0.1 lbs
Scale	NCI	3220	6	± 0.1-lb
Readout	GSE	450	8	± 0.1-lb
Analytical balance	Ohaus	G-110	28	±0.0005 grams
Audit weights	Ainsworth	4254S	29	Class S
Moisture Meter	Delmhorst	RC-1C	49	±1%-0-20 & ± 2% > 20
Type K T/C wire	Omega		500	± 2°F, 95% CL
Type K meter	Omega	199	54	± 2°F
Temp/RH/DP indicator	Dickson	TH300	639	± 1.8 (F), +/- 2% (RH)

ITS EQUIPMENT CALIBRATION RECORD

ITS# #9, 10, 11

DESCRIPTION: CO, CO2, O2 Analyzers

MANUFACTURER: Horiba & Beckman

SERIAL #: #9 CO PIR-2000 6110019 MODEL: #10 CO2 PIR-2000 607023 #11 O2 755 1001926

EQUIPMENT LOCATION:

PURPOSE & ACCURACY: ± 1% of FS

CALIBRATION SPECIFICATIONS/INTERVAL: 6 mos.

CALIBRATION DATE	NEXT CALIBRATION	CALIBRATION AGENCY	CAL. BY	RESULTS/ADJUST.
7/16/99	1/16/00	In house	RA	
1/17/00	7/17/00	"	RA	
7/6/00	1/06/01	"	RA	OK
6/1/01	11/1/01	"	BK	

MAINTENANCE AND REPAIR:

DATE OUT OF SERVICE	DATE BACK IN SERVICE	REPAIR AGENCY	DESCRIPTION OF REPAIR

ITS Intertek Testing Services NA Inc.

Middleton, Wisconsin

CALIBRATION DATE: 6/1/01 **CALIBRATED BY:** WK
REVIEWED BY: AJ

DESCRIPTION: Gas Analyzers
Located in EE console

SERIAL NUMBER: 6110019 CO — **WHI INVENTORY #009**
SERIAL NUMBER: 607023 CO_2 — **WHI INVENTORY #010**
SERIAL NUMBER: 1001926 O_2 — **WHI INVENTORY #011**

GAS ANALYZER RESPONSE TIME
CALIBRATION GAS USED

	CO	CO_2	O_2
Analysis:	.994	9.99	10.2
Meter Reading Direct Connection:	.98	9.63	10.17
90% of Analysis:	.88	8.67	9.15

- Meters set with zero gas and span gas.
- Calibration gas routed through impinger train.
- Zero gas was introduced after each time trial to return meter to zero.

CO 90% (.88)

Trial	Time
1.	5 sec
2.	5 sec
3.	6 sec
Average	5.3 sec

100% (.98)

Trial	Time
1.	7 sec
2.	7 sec
3.	9 sec
Average	7.6 sec

CO_2 90% (8.67)

Trial	Time
1.	6 sec
2.	5 sec
3.	4 sec
Average	5 sec

100% (9.63)

Trial	Time
1.	18 sec
2.	15 sec
3.	15 sec
Average	16 sec

O_2 90% (9.15)

Trial	Time
1.	11 sec
2.	12 sec
3.	13 sec
Average	12 sec

100% (10.17)

Trial	Time
1.	14 sec
2.	16 sec
3.	15 sec
Average	15 sec

ITS EQUIPMENT CALIBRATION RECORD

ITS# 12, 13, 14

DESCRIPTION: Dry Gas Meter Calibration

MANUFACTURER: ① Rockwell T-110 #26866 #12
② Rockwell T-110 #26873 #13

SERIAL #: ③ Rockwell T-110 #27892 MODEL: #14

EQUIPMENT LOCATION: E & E

PURPOSE & ACCURACY: ± .05 CFH

CALIBRATION SPECIFICATIONS/INTERVAL: 6 months

CALIBRATION DATE	NEXT CALIBRATION	CALIBRATION AGENCY	CAL. BY	RESULTS/ADJUST.
7/06/00	1/06/01	In-house	RA	OK
1/31/01	7/31/01	"	AL	OK
7/30/01	1/30/01	"	WL	ok

MAINTENANCE AND REPAIR:

DATE OUT OF SERVICE	DATE BACK IN SERVICE	REPAIR AGENCY	DESCRIPTION OF REPAIR

SPIROMETER

Date:	07/30/01	Baro:	29.38		Meter Number	13	Inventory Numbe	14		
By:										

Run Number	Meter Initial	Barometric Pressure	Spirometer Temperature	Vapor Pressure of H_2O (Hg)	Meter Temperature	Meter Pressure	Measurement Inches	Spirometer Volumn	Meter Final	Y
1	572.46	29.38	80	1.0220	71	1.7	23.9375	1.0881	573.444	1.0495
2	573.444	29.38	81	1.0560	72	1.6	23.1875	1.0540	574.395	1.0507
3	574.395	29.38	81	1.0560	71.5	1.7	23.1875	1.0540	575.345	1.0508
4	576.333	29.38	81.5	1.0735	71	1.6	24.0625	1.0938	577.315	1.0523
5	577.315	29.38	83	1.1270	71.5	1.6	24.5625	1.1165	578.316	1.0499
6	578.316	29.38	82	1.0910	72	1.6	23.6875	1.0767	579.283	1.0523
									AVERAGE	1.0509

					Meter Number	1	Inventory Numbe	12		

Run Number	Meter Initial	Barometric Pressure	Spirometer Temperature	Vapor Pressure of H_2O (Hg)	Meter Temperature	Meter Pressure	Measurement Inches	Spirometer Volumn	Meter Final	Y
1	468.828	29.38	80	1.0220	74	1.7	23.9375	1.0881	469.843	1.0232
2	469.843	29.38	81	1.0560	74	1.6	23.1875	1.0540	470.83	1.0162
3	470.83	29.38	81	1.0560	74	1.5	23.1875	1.0540	471.811	1.0224
									AVERAGE	1.0206

					Meter Number	2	Inventory Numbe	13		

Run Number	Meter Initial	Barometric Pressure	Spirometer Temperature	Vapor Pressure of H_2O (Hg)	Meter Temperature	Meter Pressure	Measurement Inches	Spirometer Volumn	Meter Final	Y
1	806.912	28.76	81.5	1.0735	73	1.6	24.0625	1.0938	807.912	1.0364
2	807.912	28.76	83	1.1270	74	1.6	24.5625	1.1165	808.937	1.0292
3	808.937	28.76	82	1.0910	74	1.6	23.6875	1.0767	809.93	1.0278
									AVERAGE	1.0311

reviewed MP

Calibration Standards

NIST Traceable #	Instrument ID#	Description	Model	Calibration Date	Date Due
1000026619	01-0098	Stopwatch	810033	20 APR 2000	20 APR 2001
1000027795	01-0287	Resonant Sensor Barometer	DPI 141	27 APR 2000	27 APR 2001
1000051990	01-0818	Humidity & Temperature Meter	HM34C	01 MAR 2001	01 MAR 2002
1000052381	01-0178	Thermistor Thermometer	600-8525	22 MAR 2001	22 MAR 2002
1000055291	01-0103	Electronic Manometer	Medm 500	05 APR 2001	05 APR 2002

ITS EQUIPMENT CALIBRATION RECORD

ITS# 22

DESCRIPTION: Manometer 0-1" Inclined

MANUFACTURER:

SERIAL #: 882 MODEL: 125AV

EQUIPMENT LOCATION: Emissions Lab - E+E

PURPOSE & ACCURACY: ± 1% of FS (0.01 in)

CALIBRATION SPECIFICATIONS/INTERVAL: ~~6 mos.~~ Yearly

CALIBRATION DATE	NEXT CALIBRATION	CALIBRATION AGENCY	CAL. BY	RESULTS/ADJUST.
3/17/94	9/17/94	Inhouse	WK	
10/1/94	4/1/95	"	WK	
4/11/95	10/11/95	"	RA	
10/16/95	4/16/96	"	RA	
4/19/96	10/19/96	"	WK	
10/9/96	4/9/97	"	RB	
5/14/97	11/14/97	"	RA	
12/16/97	6/16/98	"	RA	
8/12/98	2/12/99	"	RA	
1-22-99	7-22-99	"	RA	
7/16/99	1/16/00	"	RA	
1/14/00	7/14/00	"	RA	
2/13/01	2/13/02	"	AL	0.0015-in

MAINTENANCE AND REPAIR:

DATE OUT OF SERVICE	DATE BACK IN SERVICE	REPAIR AGENCY	DESCRIPTION OF REPAIR

ITS Intertek Testing Services NA Inc.

Middleton, Wisconsin

CALIBRATION DATE: 2/12/04 **CALIBRATED BY:** AJC
REVIEWED BY: [signature]

DESCRIPTION: Manometer Inclined 0-1" **MODEL: 125 AV**
Located in EE lab

SERIAL NEMBER: 8 82 **WHI INVENTORY #022**

MICROTECTOR	MANOMETER	DEVIATION IN.
.379	.757	0.001
.287	.576	0.002
.225	.454	0.004
.131	.260	0.002
.054	.105	0.003
.021	.042	0
.004	.008	0
.442	.886	0.002
.335	.670	0

AVERAGE DEVIATION = 0.0015 **INCHES**

Note: Microtector reading is exactly ½ of the manaometer reading

ITS EQUIPMENT CALIBRATION RECORD

ITS No. 024

DESCRIPTION: Manometer 0-10"

MANUFACTURER: Dwyer

SERIAL No: 400 MODEL: _____

EQUIPMENT LOCATION: _____

PURPOSE & ACCURACY: ±.02 in from 0-1" ±.1 from 1"-10"

CALIBRATION SPECIFICATIONS/INTERVAL: 6 months

CALIBRATION DATE	NEXT CALIBRATION	CALIBRATION AGENCY	CAL. BY	RESULTS/ADJUST
5/15/00	5/15/01	in-house	WK	ok
8/20/01	2/20/01	" "	AL	ok

MAINTENANCE AND REPAIR:

DATE OUT OF SERVICE	DATE BACK IN SERVICE	REPAIR AGENCY	DESCRIPTION OF REPAIR

ITS Intertek Testing Services NA Inc.

Middleton, Wisconsin

CALIBRATION DATE: 8/20/01 **CALIBRATED BY:** RDY
REVIEWED BY: [signature]
DESCRIPTION: Manometer Inclined 0-10" **MODEL:** Dwyer

SERIAL NUMBER: 400 **WHI INVENTORY #024**

Item used to calibrate: Microtector WHI No. 103

MICROTECTOR	MICROTECTOR MANOMETER ("W.C.)	manometer ACTUAL	Difference ~~DEVIATION %~~
0.138	0.276	0.270	-.006
0.277	0.554	0.540	-.014
0.313	0.626	0.620	-.006
0.428	0.856	0.840	-.016
0.626	1.252	1.250	-.002
0.939	1.878	1.870	-.008

AVERAGE ~~DEVIATION~~ (Difference) = .009 "W.C.

$$\text{STD DEV} = \sqrt{\frac{n\sum x^2 - \left(\sum x\right)^2}{n(n-1)}} = .005 \text{ in. w.c.}$$

TRACEABILITY TO

NATIONAL INSTITUTE OF STANDARDS & TECHNOLOGY

All PRINCO Barometers, Model Series 453 and 469, have been tested in comparison with the Fortin type mercurial barometer, serial no. W12655, which was calibrated on May 3rd 1994 against a Hass primary standard Type MS-3 Micrometer Standard Barometer, serial number 2510, certified by the National Institute of Standards & Technology (NIST Identification No. P-7485).

Barometer scales are positioned to read correctly with no correction for capillary depression. Compensation has been made for the average condition of capillary by tapping the instrument slightly before each reading to bring the meniscus height to its average value. The length of the scale of this barometer has a zero correction at 62°F on the English side and 0°C on the metric side. The density of the mercury is standard at 0°C. To correct for temperature of both density and scale length, use the combination temperature correction table as published in National Weather Service, Circular F. (See PRINCO Instruction Manual). To correct for gravity use the gravity correction tables in the same publication. No gravity correction is needed at 45° latitude.

This barometer is accurate to ±0.3 mb, 0.2 mm, or 0.01 inch of mercury when carefully set and read, and after temperature and gravity corrections have been applied. The thermometer on the barometer is accurate to ±0.5°C.

The National Institute of Standards & Technology does not state any recommendations for a barometer to be re-certified.

If the barometer is not abused in any way it should never go out of calibration.

Princo Instruments, Inc. recommends that you return the barometer every 3 to 5 years.

ITS EQUIPMENT CALIBRATION RECORD

ITS# 554

DESCRIPTION: Magnehelic

MANUFACTURER: Dwyer ~~2000-00~~

SERIAL #: R990430MP21 MODEL: 2000-00

EQUIPMENT LOCATION: E&E

PURPOSE & ACCURACY: ± 0, 005-in. WL

CALIBRATION SPECIFICATIONS/INTERVAL: 6 mo.

CALIBRATION DATE	NEXT CALIBRATION	CALIBRATION AGENCY	CAL. BY	RESULTS/ADJUST.
8-10-99	2-10-00	In-house	RA	
1-14-00	7-14-00	"	"	
5/15/00	11/15/00	"	RA	
2/2/01	8/2/01	"	AL	0.0028"
7/29/01	1/29/02	"	WK	ave .003 STDEV .002

MAINTENANCE AND REPAIR:

DATE OUT OF SERVICE	DATE BACK IN SERVICE	REPAIR AGENCY	DESCRIPTION OF REPAIR

ITS Intertek Testing Services NA Inc.

Middleton, Wisconsin

1/2

CALIBRATION DATE: 7/29/01 **CALIBRATED BY:** MC

REVIEWED BY: ~~[illegible]~~

DESCRIPTION: Magnehelic **MODEL: Dwyer 2000-00**

SERIAL NUMBER: R990430MP21 **WHI INVENTORY #554**
Located in E&E Console

USING: MICROTECTOR #103

wrote down last average

MC

MICROTECTOR	MICROTECTOR ACTUAL	MAGNEHELIC	DEVIATION
.111	.222	.222	0 %
.086	.172	.175	~~2.3%~~ 1.71
.071	.142	.144	~~3.4%~~ 1.39
.034	.068	.072	~~5.9%~~ 5.56
.054	.108	.112	~~3.7%~~ 3.57
.048	.096	.101	~~4.2%~~ 4.95
.021	.042	.046	~~9.5%~~ 8.70
.012	.024	.025	~~8.3%~~ 4.08

AVERAGE DEVIATION = 3.73

~~Std dev =~~
NA

See page 2/2 for correct std. deviation & differences.

ITS Intertek Testing Services NA Inc.

Middleton, Wisconsin

CALIBRATION DATE:_____ **CALIBRATED BY:**_____
REVIEWED BY:_____

DESCRIPTION: Magnehelic **MODEL: Dwyer 2000-00**

SERIAL NUMBER: R990430MP21 **WHI INVENTORY #554**
Located in E&E Console

USING: MICROTECTOR #103

MP 8/20/01

MICROTECTOR (in.)	MICROTECTOR ACTUAL (in. W.C.)	MAGNEHELIC (in. W.C.)	Difference (in. W.C.)
			.000
			.003
			.002
			.004
			.004
			.005
			.004
			.001

AVERAGE DIFFERENCE = .003 **in. W.C.** MP 8/20/01

STANDARD DEVIATION OF DIFFERENCE = .002 **in. W.C.** MP 8/20/01

ITS EQUIPMENT CALIBRATION RECORD 6, 25, ITS# 8 & 259

DESCRIPTION: Weigh

MANUFACTURER: Tronix

SERIAL #: (6)(8)6800082 (25)(259)03082 MODEL: (8) NCI 5780 (259) WI 110

EQUIPMENT LOCATION:

PURPOSE & ACCURACY: .1 16

CALIBRATION SPECIFICATIONS/INTERVAL: 6 Months

CALIBRATION DATE	NEXT CALIBRATION	CALIBRATION AGENCY	CAL. BY	RESULTS/ADJUST.
8-11-98	2-11-99	In-house.	RA	
5-19-98	11-19-98	Cream City	—	
11-98	5-99	CREAM CITY	JEFF	
5/21/99	11/21/99	" "	CC	
11/99	5/00	Cream City	Jeff	
3/00	9/00	" "	"	~~Big Stick only~~
9/27/00	3/27/01			
4/12/01	10/12/01	" "		OK

MAINTENANCE AND REPAIR:

DATE OUT OF SERVICE	DATE BACK IN SERVICE	REPAIR AGENCY	DESCRIPTION OF REPAIR

6 & 8

Certificate of Calibration

CREAM CITY SCALE, CO INC.

2009 S. Stoughton Rd., Madison, WI 53716 (608) 222-9427 or (888) 934-4448

CUSTOMER ITS DATE 9/12/01

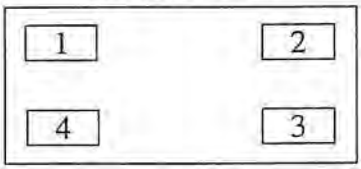
ADDRESS

CITY, STATE & ZIP Madison

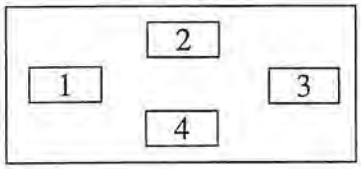
INDICATOR MFG.	CSE	CAPACITY	100LL	CLASS	III
MODEL	950	DIVISIONS	.01	ACCURACY	1/2
SERIAL NO.	101772	LOCATION	Fire Dept test	TOLERANCES USED	HB44
BASE MFG.	NCI	I.D. #	6, 8		
MODEL	3730	CALIBRATION INTERVAL	Semi Annual		
SERIAL NO.	790193	NEXT CALIBRATION DUE	10/01		

SHIFT TEST

FLOOR SCALE



BENCH SCALE



SECTION	LOAD	READING	ERROR
1	50	50	—
2	50	50	—
3	50	50	—
4	50	50	—

IS SHIFT TEST WITHIN TOLERANCE ( ) YES ( ) NO ( ) ADJUSTED

INCREASING LOAD TEST

PRELIMINARY LOAD TEST

SUBSTITUTION WEIGHT	TEST WEIGHT	READING	ERROR
	5	5	—
	10	10	—
	25	25	—
	50	50	—
	75	75	—
	100	100	—

IS SCALE WITHIN MAINTENANCE TOLERANCE (X) Y ( ) N
(if no, see final load test)

FINAL LOAD TEST AFTER ADJUSTMENT

SUBSTITUTION WEIGHT	TEST WEIGHT	READING	ERROR

IS SCALE WITHIN ACCEPTANCE TOLERANCE ( ) Y ( ) N

WAS SCALE WITHIN CUSTOMERS REQUIRED ACCURACY? (X) Y ( ) N

COMMENTS:

TEST WEIGHT CLASSIFICATION F

NIST TRACEABILITY CERTIFICATE NO. W00-223

LIST TEST WEIGHTS USED BY SERIAL NO. K-75, 71, 72

SCALES WERE CALIBRATED WITH THE CERTIFIED TEST WEIGHTS, ADJUSTMENTS TO RESTORE AND/OR MAINTAIN THE ACCURACY OF THE SCALE CONFORM TO THE TOLERANCES ESTABLISHED BY THE NATIONAL INSTITUTE OF STANDARDS & TECHNOLOGY AS SPECIFIED IN HANDBOOK 44.

TECHNICIAN

White - Customer Copy Canary - Office Copy

#. 25 & 259

Certificate of Calibration

CREAM CITY SCALE, CO INC.

2009 S. Stoughton Rd., Madison, WI 53716 (608) 222-9427 or (888) 934-4448

CUSTOMER ITS DATE 9/12/14

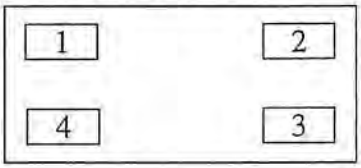
ADDRESS

CITY, STATE & ZIP Madison WI

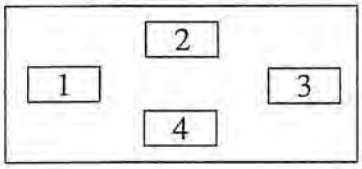
INDICATOR MFG.	Weigh-Tronix	CAPACITY	100	CLASS	III
MODEL	WI-110	DIVISIONS	.1	ACCURACY	1%
SERIAL NO.	30321	LOCATION	Free Phone Test	TOLERANCES USED	HB44
BASE MFG.	Toledo	I.D. #	25+259		
MODEL	Dormant	CALIBRATION INTERVAL		Semi Annual	
SERIAL NO.	N/A	NEXT CALIBRATION DUE		10/01	

SHIFT TEST

FLOOR SCALE



BENCH SCALE



SECTION	LOAD	READING	ERROR
1	250	250.2	+.2
2	250	250	—
3	250	250	—
4	250	250	—

IS SHIFT TEST WITHIN TOLERANCE ( ) YES ( ) NO ( ) ADJUSTED

INCREASING LOAD TEST

PRELIMINARY LOAD TEST

SUBSTITUTION WEIGHT	TEST WEIGHT	READING	ERROR
	100	100	—
	200	200	—
	300	300.1	+.1
	400	400.1	+.1
	500	500.1	+.1

IS SCALE WITHIN MAINTENANCE TOLERANCE (X) Y ( ) N
(if no, see final load test)

FINAL LOAD TEST AFTER ADJUSTMENT

SUBSTITUTION WEIGHT	TEST WEIGHT	READING	ERROR
	100	100	—
	200	200	—
	300	300	—
	400	400	—
	500	500	—

IS SCALE WITHIN ACCEPTANCE TOLERANCE (X) Y ( ) N

WAS SCALE WITHIN CUSTOMERS REQUIRED ACCURACY? (X) Y ( ) N

COMMENTS:

TEST WEIGHT CLASSIFICATION F

NIST TRACEABILITY CERTIFICATE NO. 100-227

LIST TEST WEIGHTS USED BY SERIAL NO. 71-80

SCALES WERE CALIBRATED WITH THE CERTIFIED TEST WEIGHTS, ADJUSTMENTS TO RESTORE AND/OR MAINTAIN THE ACCURACY OF THE SCALE CONFORM TO THE TOLERANCES ESTABLISHED BY THE NATIONAL INSTITUTE OF STANDARDS & TECHNOLOGY AS SPECIFIED IN HANDBOOK 44.

TECHNICIAN

White - Customer Copy Canary - Office Copy

ITS EQUIPMENT CALIBRATION RECORD

ITS# 28

DESCRIPTION: Analytical Balance

MANUFACTURER: Ohaus

SERIAL #: 5336 MODEL: G110

EQUIPMENT LOCATION: E & E

PURPOSE & ACCURACY: ±.0005 g

CALIBRATION SPECIFICATIONS/INTERVAL: 6 months

CALIBRATION DATE	NEXT CALIBRATION	CALIBRATION AGENCY	CAL. BY	RESULTS/ADJUST.
6-2-97	12-2-97	In-house	RA	
6/25/98	12-25-98	"	WK	
12/11/98	6/11/98	"	RA	
6/1/99	12/1/99	"	RA	
1/14/00	7/14/00	"	RA	
7/6/00	1/6/01	"	RA	OK
2/1/01	8/1/01	"	AL	0.00019
7/30/01	1/30/01	"	WK	.00018 ave dif .00014 std dv.

MAINTENANCE AND REPAIR:

DATE OUT OF SERVICE	DATE BACK IN SERVICE	REPAIR AGENCY	DESCRIPTION OF REPAIR

ITS Intertek Testing Services NA Inc.

Middleton, Wisconsin

CALIBRATION DATE: 7/30/01 **CALIBRATED BY:** [illegible]
REVIEWED BY: [illegible]
DESCRIPTION: Analytical Balance **MODEL:** (Ohaus) Galaxy 110

SERIAL NUMBER: 5336 **WHI INVENTORY #028**

USING: Ainsworth Class S Weight WHI #29

WEIGHT	MEASURED	DIFFERENCE (g)
2 mg	BROKEN WEIGHT	
5 mg	0.00519	0.0001
10 mg	0.0104	0.0004
20 mg	0.0202	0.0002
50 mg	0.0499	0.0001
100 mg	0.1001	0.0001
1 g	0.9999	0.0001
20 g	20.0000	— 0 —
50 g	49.9996	00.0004
100 g	100.0002	000.0002

Average Difference = 0.0601778 **grams**

Standard Deviation = .00014 **grams** MP

WARNOCK HERSEY INTERNATIONAL, INC.
MIDDLETON, WISCONSIN 53562

AINSWORTH PRODUCTS, INC.

2050 South Pecos Street,
Denver CO 80223
(303) 934-2276

CLASS S WEIGHT SET

RANGE: 100 GRAMS TO 1 ~~GRAMS~~ MILLIGRAMS

CATALOG NO. 4254 - S SERIAL NO. 39397

	CONSTRUCTION	MATERIAL	DENSITY g/cm³ @ 20° C
GRAM WTS.	☐ 1-piece ☒ 2-piece screwknob	☒ Naval Brass, rhodium plated ☐ Brunton* Metal ☐ Stainless Steel	8.40 7.89 7.85
MILLIGRAM WTS. 30 mg & larger	☒ 1-piece	☒ Tantalum	16.6
MILLIGRAM WTS. 20 mg & smaller	☒ 1-piece	☒ Aluminum	2.7

Naval Brass average composition—60% copper, 39.25% zinc, .75% tin. ASM #4612B.

Brunton* Metal average composition—25.5% chromium, 21% nickel, 2% manganese, 1.5% silicon, .25% sulphur, phosphorus, carbon.

Stainless Steel average composition—18% chromium, 9% nickel, 1% manganese .5% silicon, .1% carbon, AISI #303

Rhodium plated weights have an undercoat of electrolytic nickel plate.

All Ainsworth weights meet or exceed the National Bureau of Standards Handbook 77, Volume III, issued February 1, 1966, Concerning: Matertial (hardness, corrosion resistance, magnetic properties, density, adjusting materials); Design (Shape, dimensions, number of pieces); Surface (irregularities, porosity, surface finish); Denominations; Markings; Constancy under variations of humidity; Packaging.

We can supply new class, S, and S-1 Sets with any range between 100g and 1 mg. New weights or weight sets and even those you are now using may be calibrated and certified by Ainsworth Products, Inc., Standards Laboratory to show traceability to National Bureau of Standards.

Made by AINSWORTH PRODUCTS, INC.
2050 South Pecos St., Denver, CO 80223

WHI #029

ITS EQUIPMENT CALIBRATION RECORD

ITS# 49

DESCRIPTION: Moisture Meter

MANUFACTURER: Delmhorst

SERIAL #: 14356 MODEL: RC-1C AND CAL. Block

EQUIPMENT LOCATION: E & E

PURPOSE & ACCURACY: ±1% -0-20 & ±2% >20

CALIBRATION SPECIFICATIONS/INTERVAL:

CALIBRATION DATE	NEXT CALIBRATION	CALIBRATION AGENCY	CAL. BY	RESULTS/ADJUST.
8/20/01	2/20/02	In-House	AL	OK

MAINTENANCE AND REPAIR:

DATE OUT OF SERVICE	DATE BACK IN SERVICE	REPAIR AGENCY	DESCRIPTION OF REPAIR

DELMHORST
INSTRUMENT CO.

WHI # 49

LETTER OF CERTIFICATION

October 12, 2000

Intertek Testing Service
8431 Murphy Dr.
Middleton, WI 53562

Gentlemen:

Subject: Moisture Content Standard Model MCS-1 Serial No. 101200

This is to certify that the primary calibration - electrical resistance - of the Delmhorst Moisture Meters has been tested on equipment whose accuracy is certified by the:

General Radio Model No. 1644-A S/N 2526
Keithley Model No. 97, S/N 283483.

The calibration of these instruments, certified by Ballantine Laboratories, Inc. with Report No. D19016 dated December 9, 1999, is traceable to the NIST.

The MCS-1 (Moisture Content Standard) is an external means to check the Delmhorst Moisture Meters for wood at two points – 12 % and 22% on the Douglas Fir, 4 Pin mode; the two points will yield readings of 12.7% and 23.6% if the meters are set on the Douglas Fir, 70°F, 2 Pin mode. The analog meters in their standard form are always set at Douglas Fir 70°F 4 Pin mode. The resistance values at said points, i.e., 120 Megohms and 1.1 Megohms verified with the same equipment as above, are within ±10% of the above values.

The analog Moisture Meters, checked with the "MCS-1" Standard, should read within (±) one division on the dial at the point(s) checked; the digital Moisture Meters should read within ±0.5 M.C. of the indicated values.

Sincerely,

John C. Laurenzi
V.P. Manufacturing

JCL: dm

51 INDIAN LANE EAST, TOWACO, NEW JERSEY 07082
PHONE: 973-334-2557. FAX: 973-334-2657
www.delmhorst.com

ITS Intertek Testing Services NA Inc.

Middleton, Wisconsin

CALIBRATION DATE: 8/20/01 **CALIBRATED BY:** [signature]
REVIEWED BY: [signature]

DESCRIPTION: Delmhorst moisture meter cabibration block MODEL : MSC-1

SERIAL No. 101200 **WHI INVENTORY # 049**

Calibrated using Fluke multimeter WHI No. 109

Calibration block position	Desired reading	Actual reading	Accepted range
12%	8.33 nS	8.72	7.50 - 9.16 nS
22%	1.1 Megohms	1.107	0.99 - 1.21 MΩ

ITS EQUIPMENT CALIBRATION RECORD

ITS# ~~FB~~ 500

DESCRIPTION: THERMOCOUPLES

MANUFACTURER: OMEGA

SERIAL #: — MODEL: —

EQUIPMENT LOCATION: E+E LAB

PURPOSE & ACCURACY: 6 mos.

CALIBRATION SPECIFICATIONS/INTERVAL: BOILING WATER ICE BATH 6 MONTHS

CALIBRATION DATE	NEXT CALIBRATION	CALIBRATION AGENCY	CAL. BY	RESULTS/ADJUST.
6-4-97	12-4-97	IN HOUSE	RA	
12-12-97	6-12-98	"	RA	
6-26/98	12-26-98	"	WK	
12-11-98	6-11-99	"	RA	
6/1/99	12/1/99	"	RA	
5/30/00	11/30/00	"	AL	± 2°F
1/24/01	7/24/01	"	AL	± 2°F (within)
7/29/01	1/29/02	"	WK	OK

MAINTENANCE AND REPAIR:

DATE OUT OF SERVICE	DATE BACK IN SERVICE	REPAIR AGENCY	DESCRIPTION OF REPAIR

ITS Intertek Testing Services NA Inc.

Middleton, Wisconsin

CALIBRATION DATE: 7/29/01 **CALIBRATED BY:** BK
REVIEWED BY: MP

Description: Thermocouple wire **WHI inventory**
No. 500

ROOM TEMPERATURE 70

Thermocouple number and location	Thermocouple immersed in boiling water	Thermocouple immersed in ice
1) Flue Gas	212	33
2) Room Temperature	211	32
3) Dry Bulb (in tunnel)	211	32
4) Wet Bulb (in tunnel)	211	32
5) Unit Top	211	33
6) Unit Back	211	33
7) Unit Right Side	211	32
8) Unit Left Side	211	32
9) Unit Bottom	211	33
10) Catalyst Downstream	211	32
11) Catalyst Center	211	33
12)	211	33
13)	211	33
14)	212	33
15)	211	33
16)	211	33
17) DGM (in)	211	33
18) DGM (out)	211	33
19) Filter (1)	211	33
20) DGM (in)	211	33
21) DGM (out)	211	33
22) Filter (2)	211	33

ITS EQUIPMENT CALIBRATION RECORD

ITS# 54

DESCRIPTION: Digital Type K Thermocouple Meter

MANUFACTURER: Omega

SERIAL #: 21662 MODEL: 199-KF-A-X

EQUIPMENT LOCATION: E+E

PURPOSE & ACCURACY: ~~±2°F~~ ±2°F (WA)

CALIBRATION SPECIFICATIONS/INTERVAL: 6 months

CALIBRATION DATE	NEXT CALIBRATION	CALIBRATION AGENCY	CAL. BY	RESULTS/ADJUST.
12/11/98	6/11/99	In house	RA	
6/1/99	12/1/99	"	RA	
1/14/00	7/14/00	"	RA	
5/24/00	11/24/00	Cal Lab		~~Cal Lab~~
11/21/00	~~5~~/21/00	Cal Lab		OK
5/8/01	~~5~~ 11/8/01	Cal Lab		

MAINTENANCE AND REPAIR:

DATE OUT OF SERVICE	DATE BACK IN SERVICE	REPAIR AGENCY	DESCRIPTION OF REPAIR

3 5-K North 126th Street
Brookfield, WI 53005
262-790-1916
262-790-1949 FAX
@callabco.com
www.callabco.com

CAL LAB

CERTIFICATE OF CALIBRATION

Certificate # 1062557

CAL LAB CO., INC. UL REGISTERED FIRM ISO 9002 A3250

Customer

Intertek Testing Services
8431 Murphy Dr.
Middleton, WI 53562

Instrument

Manufacturer: Omega
Model: 199
Description: Digital Temp. Meter
Serial #: 21662
ID #: 000054

Calibration Information

Technician: Mark Adams
Temperature: 71°F (21.7°C)
Humidity: 39%RH
Calibrated On-Site
Received Condition: Fully operational and within tolerance
Work Performed: No adjustments required and calibrated to manufacturers specifications using manufacturers procedure

Cal Interval: 6 months
Cal Date: 05/08/2001
Due Date: 11/08/2001

Calibration Standards Used

Cal:10/18/2000 Due:10/18/2001 ID#1334 Fluke 5500A/3 Calibrator Serial#6535009

This instrument was calibrated with a minimum 4:1 TUR/TAR unless otherwise stated. These represent best uncertainties. Actual uncertainties are available upon request.

Best Measurement Uncertainty

Temperature ±0.2°C

Reviewed and approved by Mike Booth Quality Team Member - Issue Date: 05/09/2001

All Functions/Ranges were checked unless otherwise stated.
This Certificate may not be reproduced except in its entirety without the written approval of CAL LAB Co., Inc.
This Report Certifies that all Calibration Standards used in the test is traceable to NIST, and the test was performed in accordance with ANSI/NCSL Z540-1-1994 (ISO/IEC 17025-1999).

ITS EQUIPMENT CALIBRATION RECORD

ITS# 639

DESCRIPTION: Temp/Rel. Humid/Dew Point Tester

MANUFACTURER: Dickson

SERIAL #: 00050593 MODEL: TH 300

EQUIPMENT LOCATION: E-E

PURPOSE & ACCURACY: ± 1.8°F, ± 2% RH

CALIBRATION SPECIFICATIONS/INTERVAL: 6 mo.

CALIBRATION DATE	NEXT CALIBRATION	CALIBRATION AGENCY	CAL. BY	RESULTS/ADJUST
11/21/00	5/21/00	Cal Lab		OK
5/8/01	11/8/01	" "		OK

MAINTENANCE AND REPAIR:

DATE OUT OF SERVICE	DATE BACK IN SERVICE	REPAIR AGENCY	DESCRIPTION OF REPAIR

'95-K North 126th Street
Brookfield, WI 53005
262-790-1916
262-790-1949 FAX
@callabco.com
www.callabco.com

CAL LAB

CERTIFICATE OF CALIBRATION

Certificate # 1062543

CAL LAB CO., INC. UL REGISTERED FIRM ISO 9002 A3250

Customer

Intertek Testing Services
8431 Murphy Dr.
Middleton, WI 53562

Instrument

Manufacturer: Dickson
Model: TH300
Description: Temp/Humidity Indicator
Serial #: 00050593
ID #: 000639

Calibration Information

Technician: Mark Adams
Temperature: 71°F (21.7°C)
Humidity: 39%RH
Calibrated On-Site
Cal Interval: 6 months
Cal Date: 05/08/2001
Due Date: 11/08/2001
Received Condition: Fully operational and within tolerance
Work Performed: No adjustments required and calibrated to manufacturers specifications using CAL LAB procedure #30

Calibration Standards Used

Cal:04/27/2001 Due:04/30/2003 ID#1385 Cole Parmer 3312-20 Psychrometer °F Serial#NONE
Cal:01/16/2001 Due:01/31/2002 ID#1390 Fluke 743B Process Calibrator Serial#7005629
Cal:09/28/2000 Due:09/30/2001 ID#1589 Thermocouple Prod. 400-T-12 T Thermocouple Probe Serial#NONE

CAL LAB CO INC CORPORATE SEAL ILLINOIS

This instrument was calibrated with a minimum 4:1 TUR/TAR unless otherwise stated. These represent best uncertainties. Actual uncertainties are available upon request.

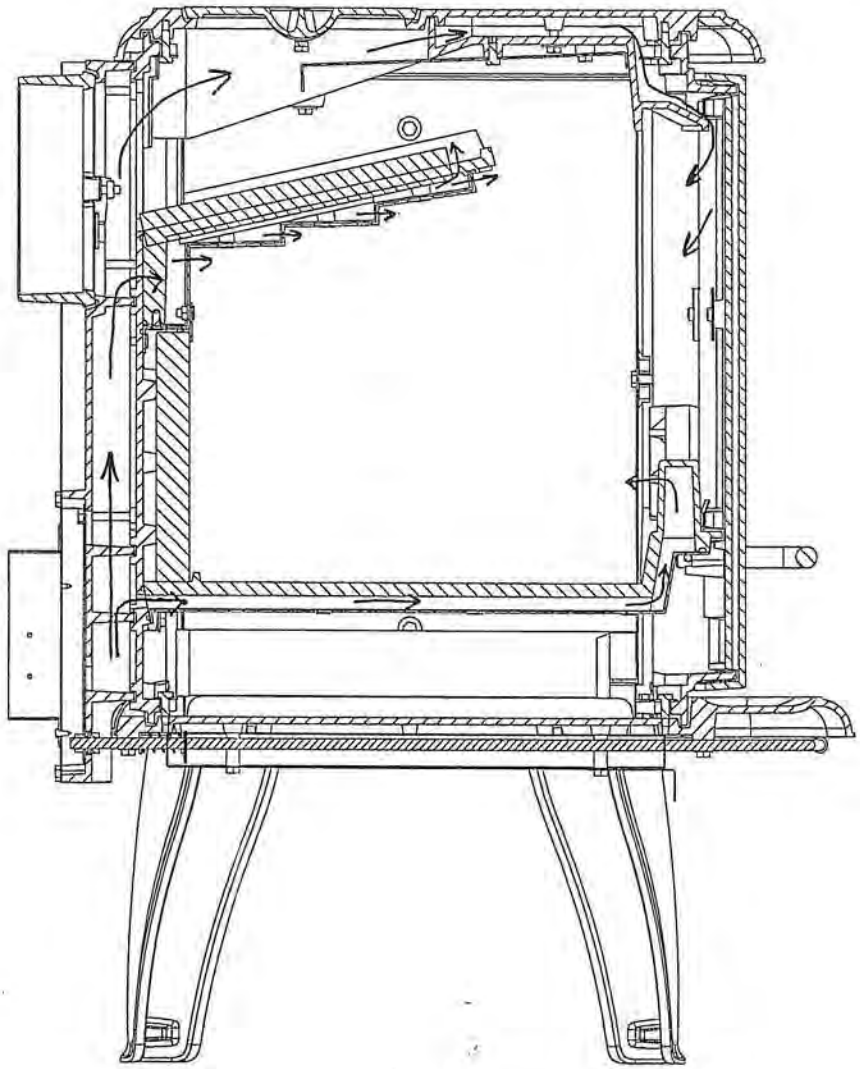
Best Measurement Uncertainty

Humidity ±3%
Temperature ±0.2°C

Reviewed and approved by Mike Boothe Quality Team Member - Issue Date: 05/09/2001

All Functions/Ranges were checked unless otherwise stated.
This Certificate may not be reproduced except in its entirety without the written approval of CAL LAB Co., Inc.
This Report Certifies that all Calibration Standards used in the test is traceable to NIST, and the test was performed in accordance with ANSI/NCSL Z540-1-1994 (ISO/IEC 17025-1999).

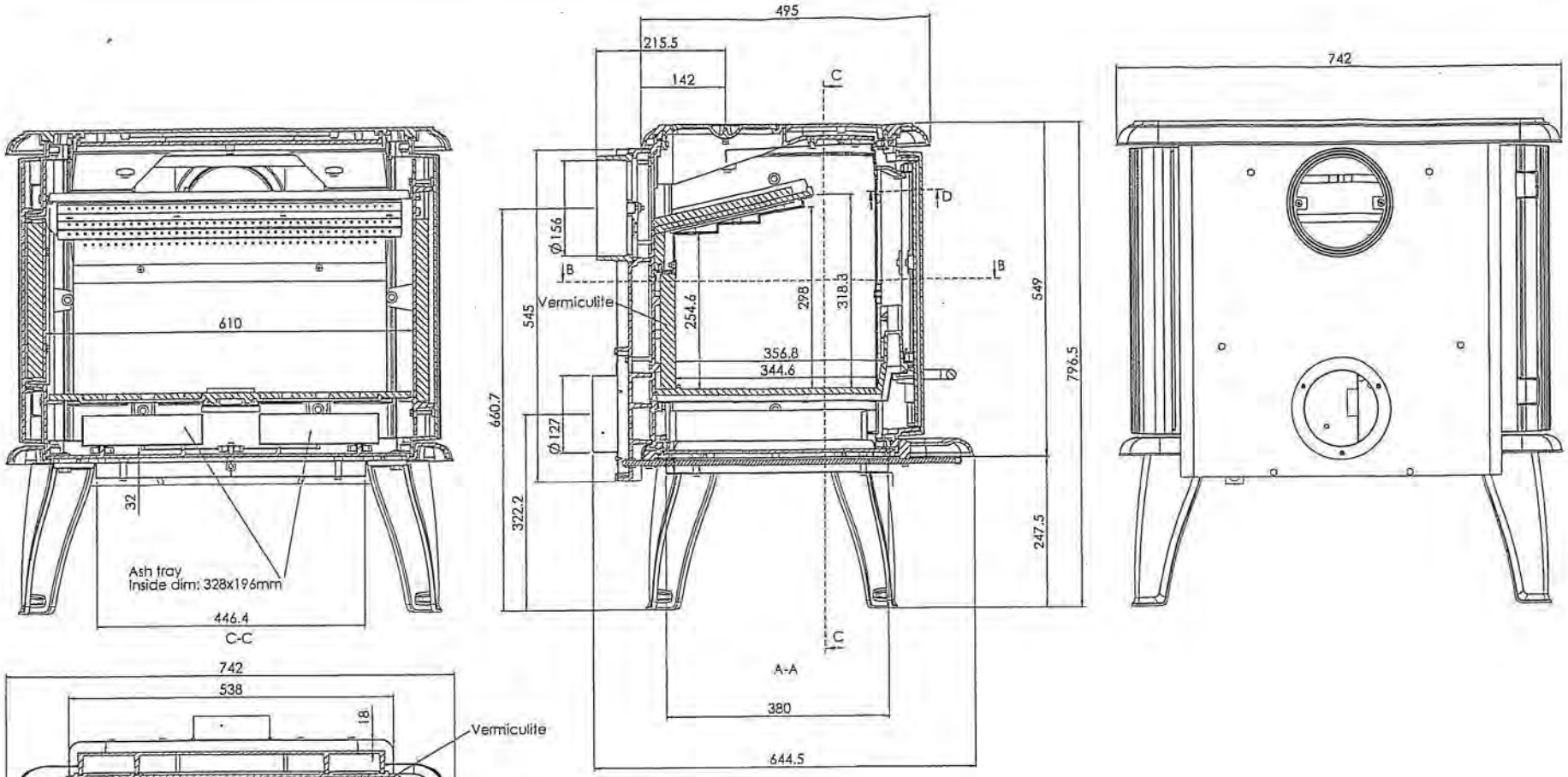
APPENDIX F

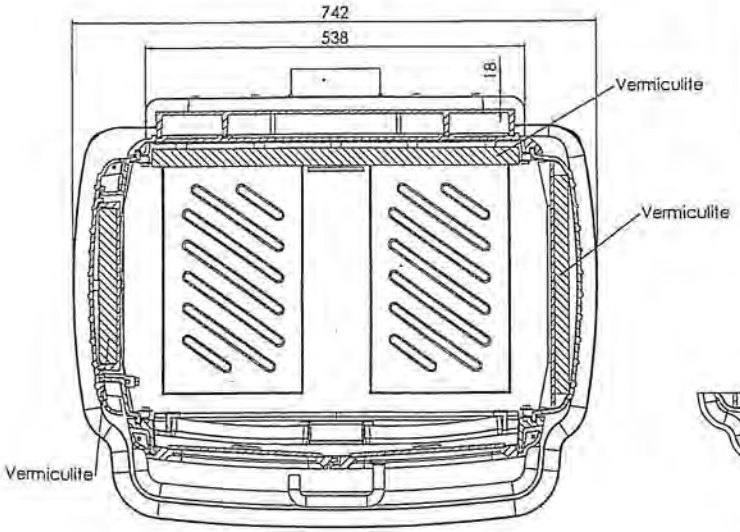


A-A

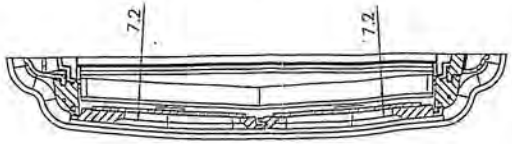
				Rev.	Revisionstekst:	Sign.:	Dato:
Materiale:	-			Titel:		Konstr.:	KDU	17.08.01
Vægt:	- kg.	Bearbejdes:	-	**Airflow diagram**		Frigivet:	-	-
Overfladebeh.:	-		- m²			Tegn.format:	A4	
Måltolerance:	Mål uden toleranceangivelse					Målforhold:	**1:5**	
Ruhedstolerance:				**Morsø 3600**		Varenr.:	-	
Værktøjsnr.:	-			morsø		Tegningsnr.:	**3600-39**	
Tegningstype:	Airflow diagram							

3600-39 Airflow diagram - Sheet1





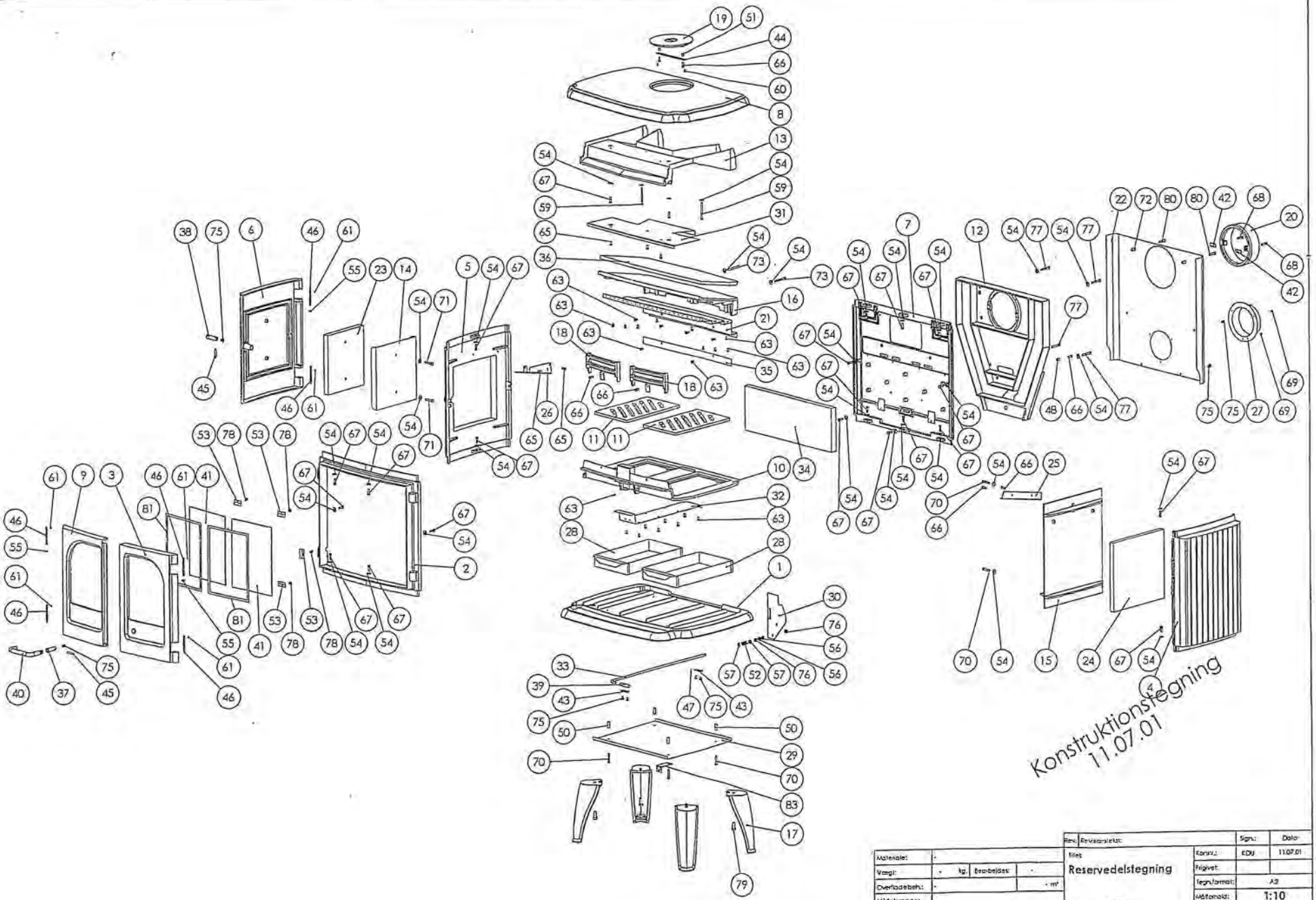
B-B



D-D

Materiale:	-				
Vægt:	- kg.	Bearbejdes:	-		
Overfladebeh.:	Males		- m²		
Måltolerance:	Mål uden toleranceangivelse				
Ruhedstolerance:					
Værktøjnr.:	-				
Tegningstype:	Godkendelsestegning				

Rev.	Revisionstekst:	Sign.:	Dato:
Titel:	Godkendelsestegning Morsø 3600 USA	Konstr.:	KDU 12.07.01
		Miglvet:	
		Tegn.format:	A2
		Målforhold:	1:5
		Varenr.:	64360021
morsø		Tegningsnr.:	3600-38



Rev.	Revisionstekst:	Sign.:	Dato:

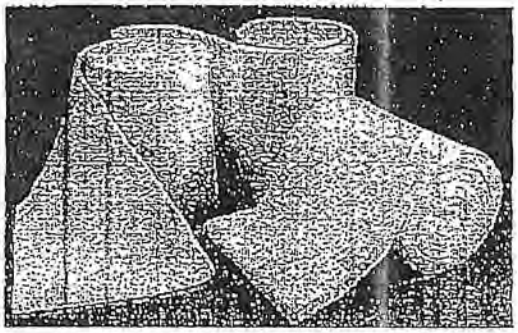
Materiale:	-	Titel: Reservedelstegning	Konstr.: KDJ 11.07.01
Vægt:	- kg. Emnebjæs: -		Tegnet:
Overfladebeh.:	- - m²		Tegnformat: A3
Måltolerance:		Morsø 3600	Måltorhold: 1:10
Ruhedstolerance:			Version: -
Vinkeltolerance:	-	morsø	Tegningsnr.: 3600-501
Tegningstype:	Eksploderet tegning		

Keramab N.V.
Haverneidelaan 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: 2905199B/MJH.mvo
Supersedes: 07041598/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

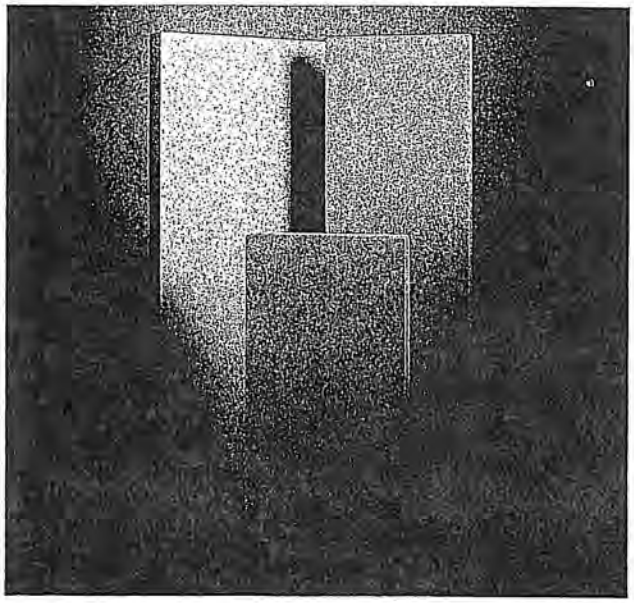
INSULFRAX® Blanket is non-combustible in accordance with BS476:Pt4 and is approved for use against cellulosic and hydrocarbon fires and for dry wrapping of structural steel. Certification details can be supplied on request.

Form:A1-050
Effective: 29051998/MJH/mvo
Supersedes: 07041998/MJH/mvo

Price List No.: III 016

KERAMAB
REFRACTORY & CERAMIC INNOVATION

SKAMOLEX VIP-12 Vermiculite Block Insulation



Packing Colour Code:
GREEN/BLACK.

Grade: VIP-12
Temp. limit: 1150°C (2102°F)

The continuous efforts to improve energy efficiency of aluminium reduction cells have intensified demands for better heat insulation in pot cathodes.

Although a number of insulating products are available on the market, many smelters are still facing the problem of reducing the temperature of penetrating bath substances to solidifying point at a line between the carbon and the insulation layer, thus achieving a freezing of bath substances before they penetrate further into the more vulnerable bottom insulation.

With this end in view there is a need for a dense intermediate insulator, of a chemistry to resist bath attacks.

SKAMOLEX VIP-12 offers a perfect solution because it combines Vermiculite chemistry and good bath resistance with ample insulation and high strength.

Placed above the bottom insulation it will cause penetrating bath to stop and solidify, due to chemical reactions that transform the low-melting mixture of sodium fluoride and aluminium fluoride into a solid mixture of magnesium fluorides and silicates of sodium and aluminium (nephaline).

Product Data

SKAMOLEX VIP-12 is a Vermiculite based refractory block insulation of high bath resistance, characterized by good insulation value and very high mechanical strength.

Precision moulding ensures blocks of smooth, non-dusting surfaces and clean edges, and permits manufacture to close dimensional tolerances, i.e. ± 2.5 mm (0.10") on length and width, and ± 1.0 mm (0.04") on thickness.

Block Sizes

Metric:
1000 mm x 305 mm,
Thicknesses:
30 - 40 - 50 mm
610 mm x 305 mm,
Thicknesses:
25 - 30 - 40 - 50 - 60 - 75 mm

US/British:
36" x 12",
Thicknesses:
1¼" - 1½" - 2"
24" x 12",
Thicknesses:
1" - 1¼" - 1½" - 2" - 2½" - 3"

Derivatives cut from standards are made to order

skamol
insulation

Skamol a/s · Østergade 58-60 · DK-7900 Nykøbing Mors · Tel.: +45 97 72 15 33 · Fax: +45 97 72 49 75
Technotherm GmbH & Co. KG. · Postfach 10 14 37 · D-41414 Neuss · Tel.: +49 2131 10 64 0 · Fax: +49 2131 10 64 64
Skamol a/s, UK Sales Office · Aden Mount · Thorrington · Essex CO7 8JJ · Tel.: +44 1 (206) 302 330 · Fax: +44 1 (206) 304 576
Skamol Inc. · 2045 Niagara Falls Blvd. · Suite 16 · Niagara Falls · NY 14304 · Tel.: +1 (716) 298 4115 · Fax: +1 (716) 298 4118

Certified under DS/ISO 9001

SKAMOLEX
VIP-12 Vermiculite
Block Insulation

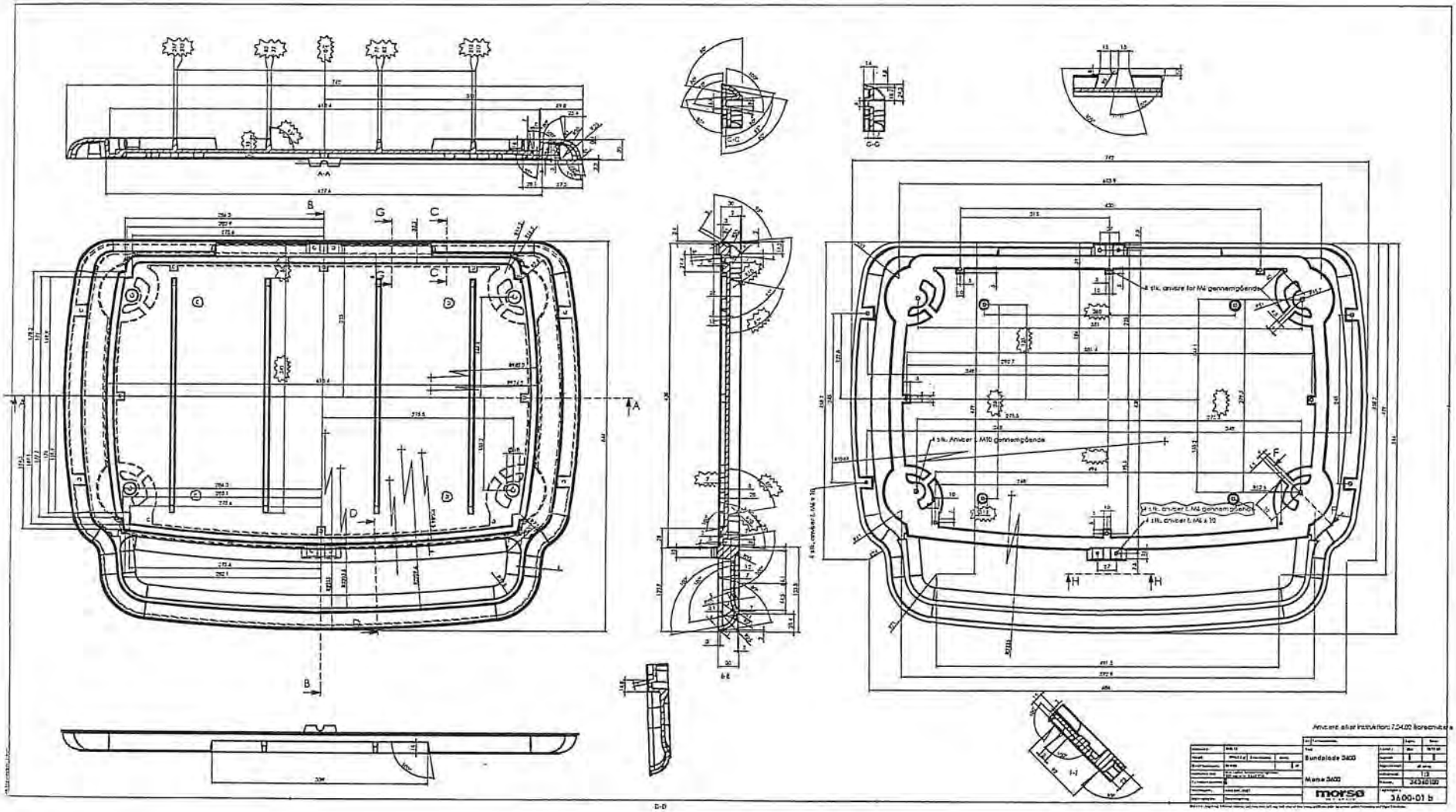
Chemical Analysis (typical)

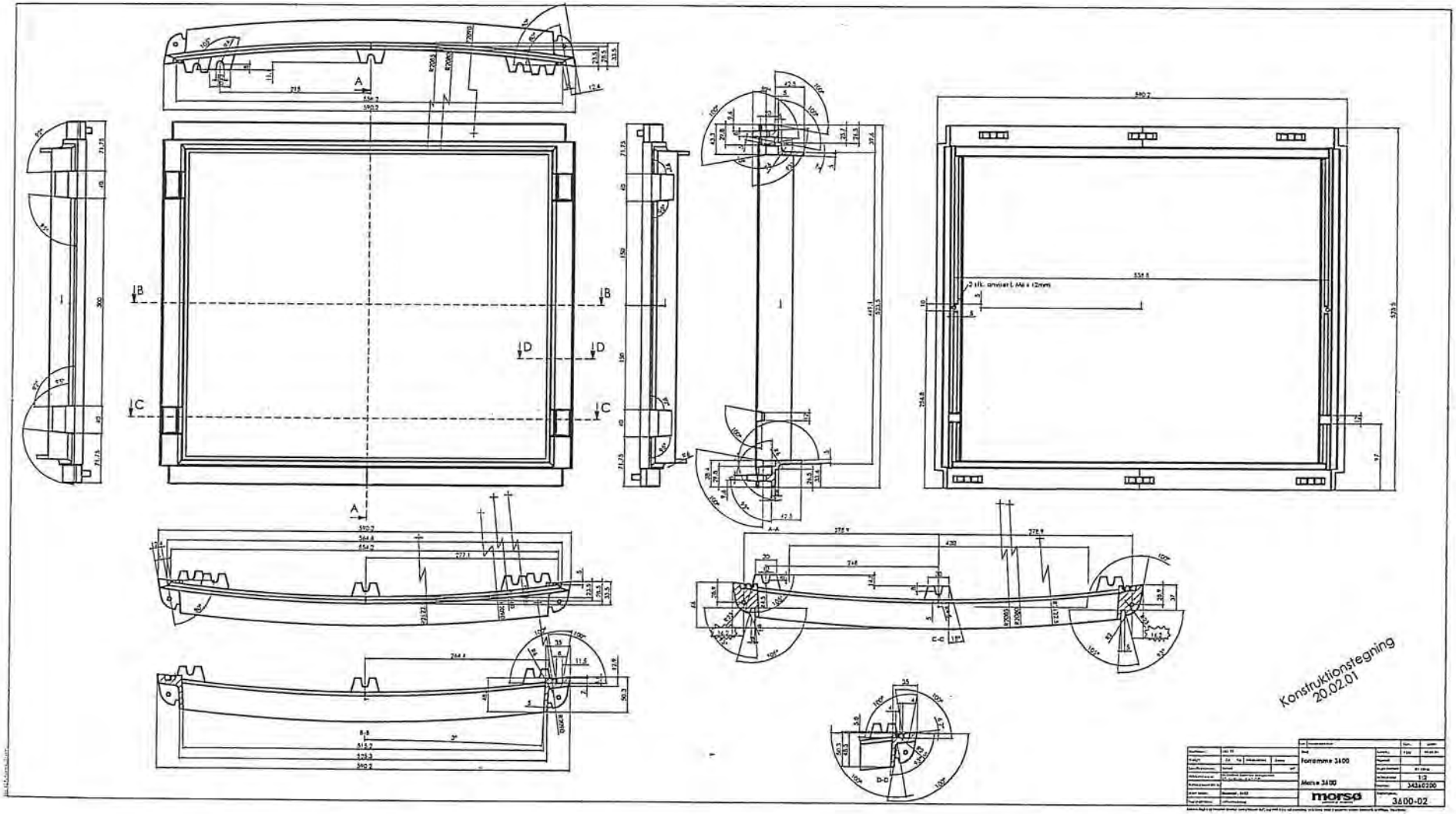
SiO_2	48%	CaO	8%
$Al_2O_3 + TiO_2$	22%	Na_2O	0.3%
Fe_2O_3	3.4%	K_2O	6%
MgO	9%	Loss on ignition (1025°C)	3.0%

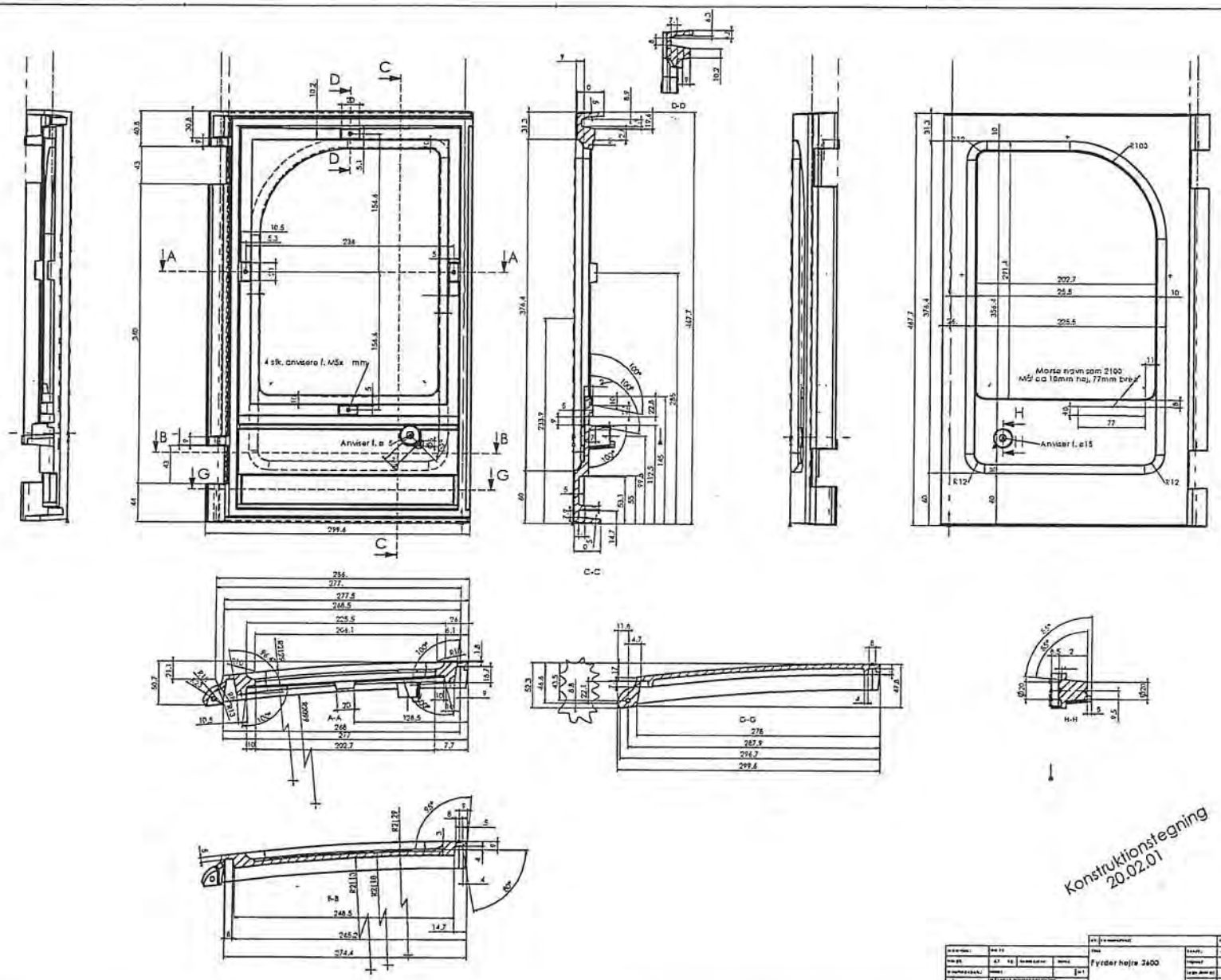
TECHNICAL PROPERTIES

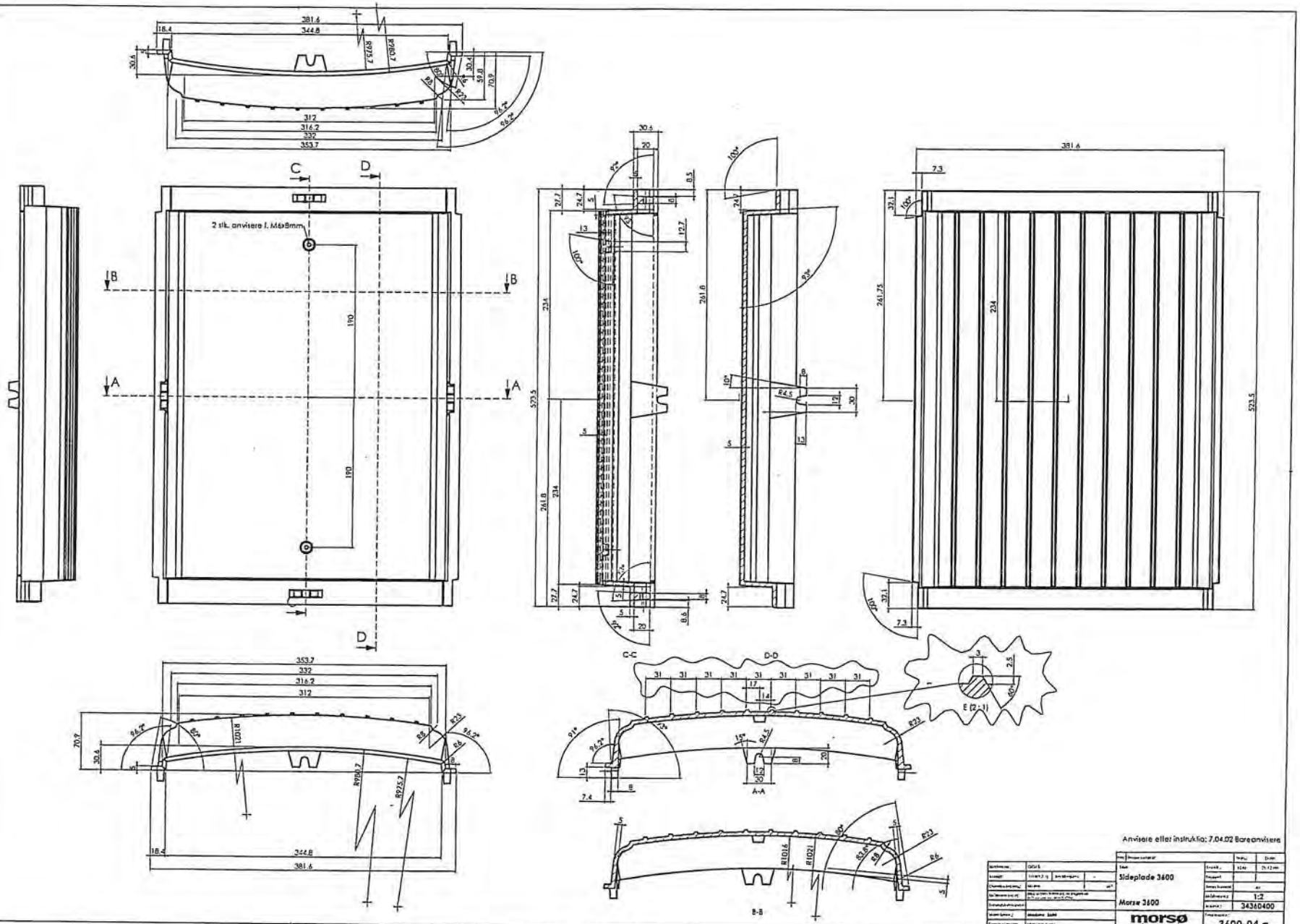
Max. service temp.	°C °F	1150 2102	Specific heat	kJ/(kg·K) BTU/(lb·°F)	0.9 0.22
Bulk density, dry	kg/m³ lbs/cu.ft.	1200 75	Coefficient of reversible thermal expansion, 20°C-750°C (68°F-1382°F)	K^{-1} $°F^{-1}$	$14x10^{-6}$ $7.8x10^{-6}$
Compressive strength	MPa lbs/sq.in.	15.0 2175	Linear reheat shrinkage, 12 h at 1100°C (2012°F) (DIN 51067, Teil 2)	%	1.0
Modulus of rupture	MPa lbs/sq.in.	3.0 435	Pyrometric cone equivalent	°C °F	1180 2156
Total porosity	%	52	Thermal conductivity at mean temp. (ASTM C-201 supplemented by ASTM C-182)		W/(m·K)
Bath resistance (»Light Metals 1986«, pp. 501-514)				200°C	0.23
				400°C	0.26
				600°C	0.29
				800°C	0.32
Cryolite Attack Ratio (k)		1.27			
Material Factor (m)		1.03			
					BTU/(sq.ft.·h·°F/in)
				392°F	1.59
				752°F	1.80
				1112°F	2.01
				1472°F	2.22

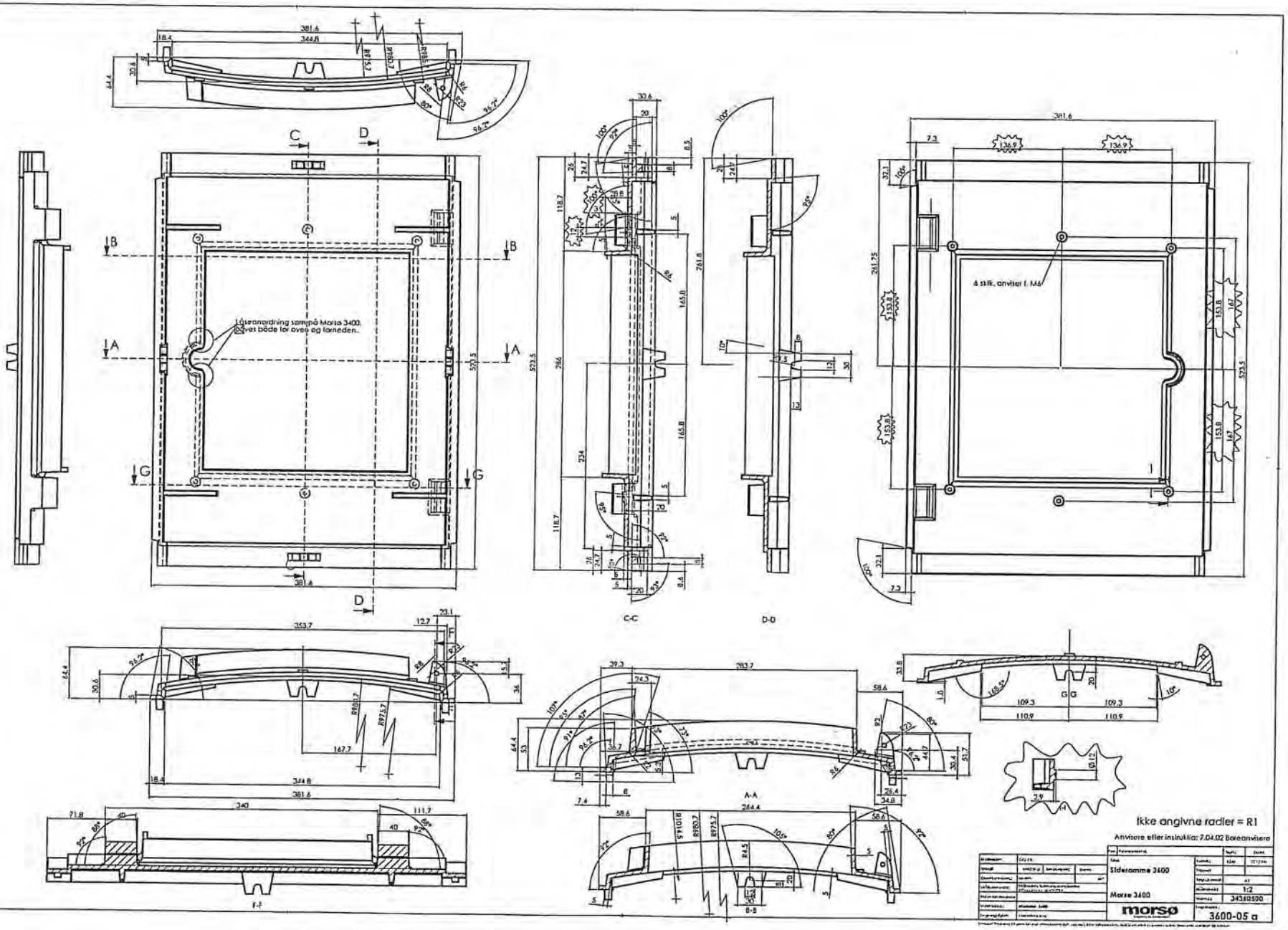
The physical and chemical properties represent typical average values obtained in accordance with accepted test methods and are subject to normal manufacturing variations. They are supplied as a technical service and are subject to change without notice.

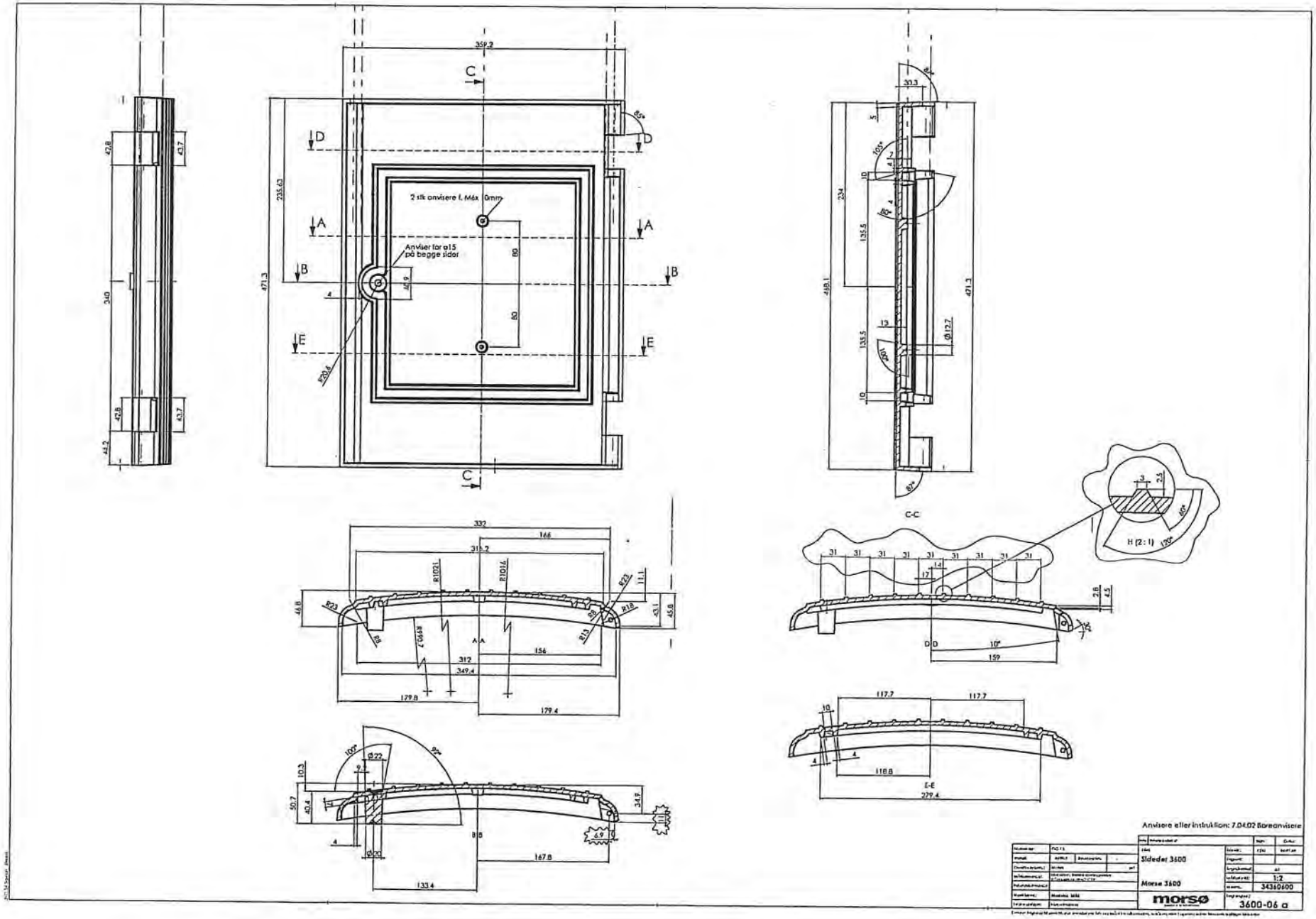

A-A
B
C
D
A
4 stk. ankre for M4 gennemgående
4 stk. Ankre i M10 gennemgående
4 stk. ankre i M4 gennemgående
4 stk. ankre i M4 à 10
H
I-I
Sundalade 3400
Mono 3400
morsø
3400-01 b

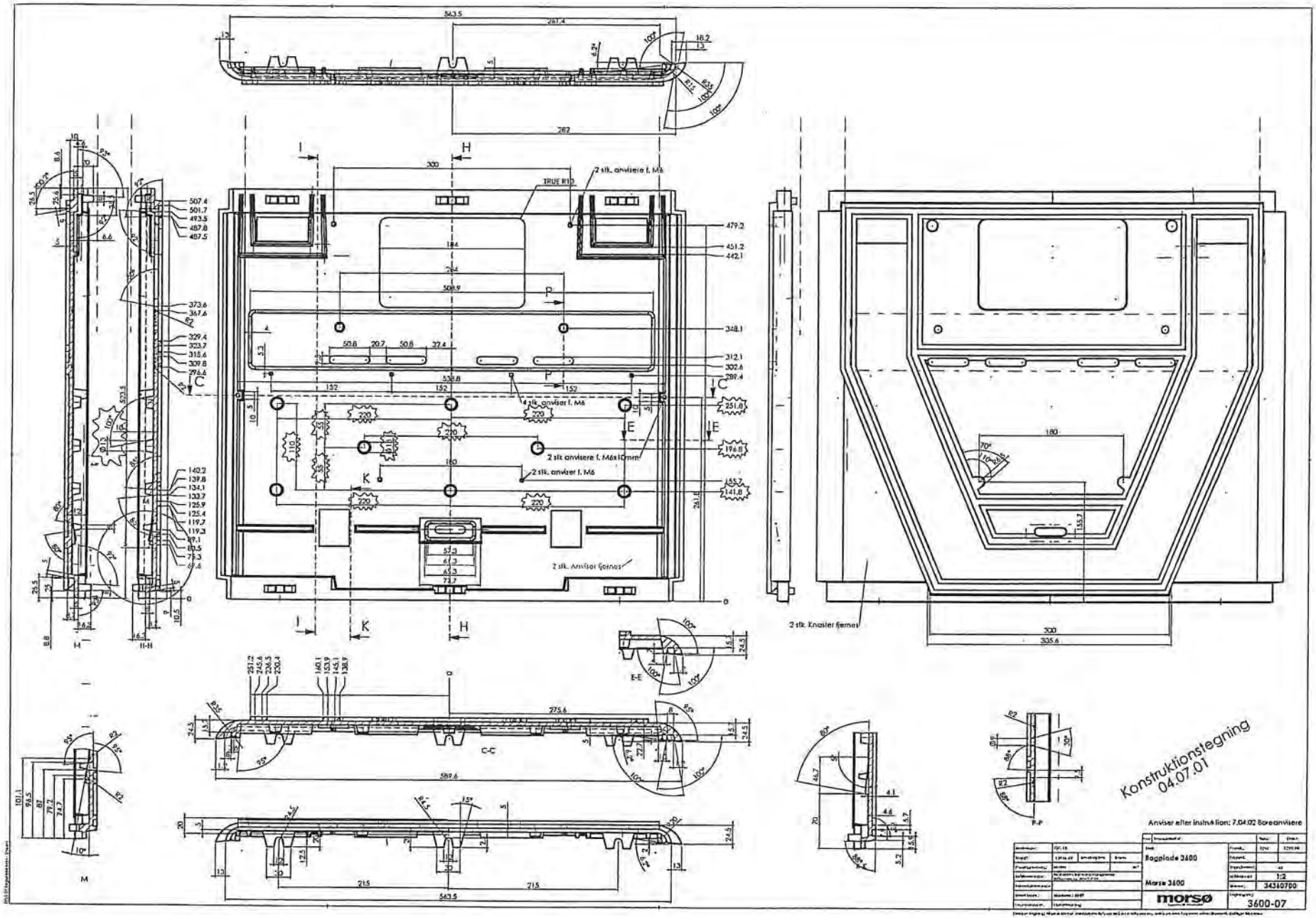

A
B
C
D
A-A
C-C
D-D
Konstruktionstegning
20.02.01
Formmme 3600
Morsø 3600
morsø
3600-02

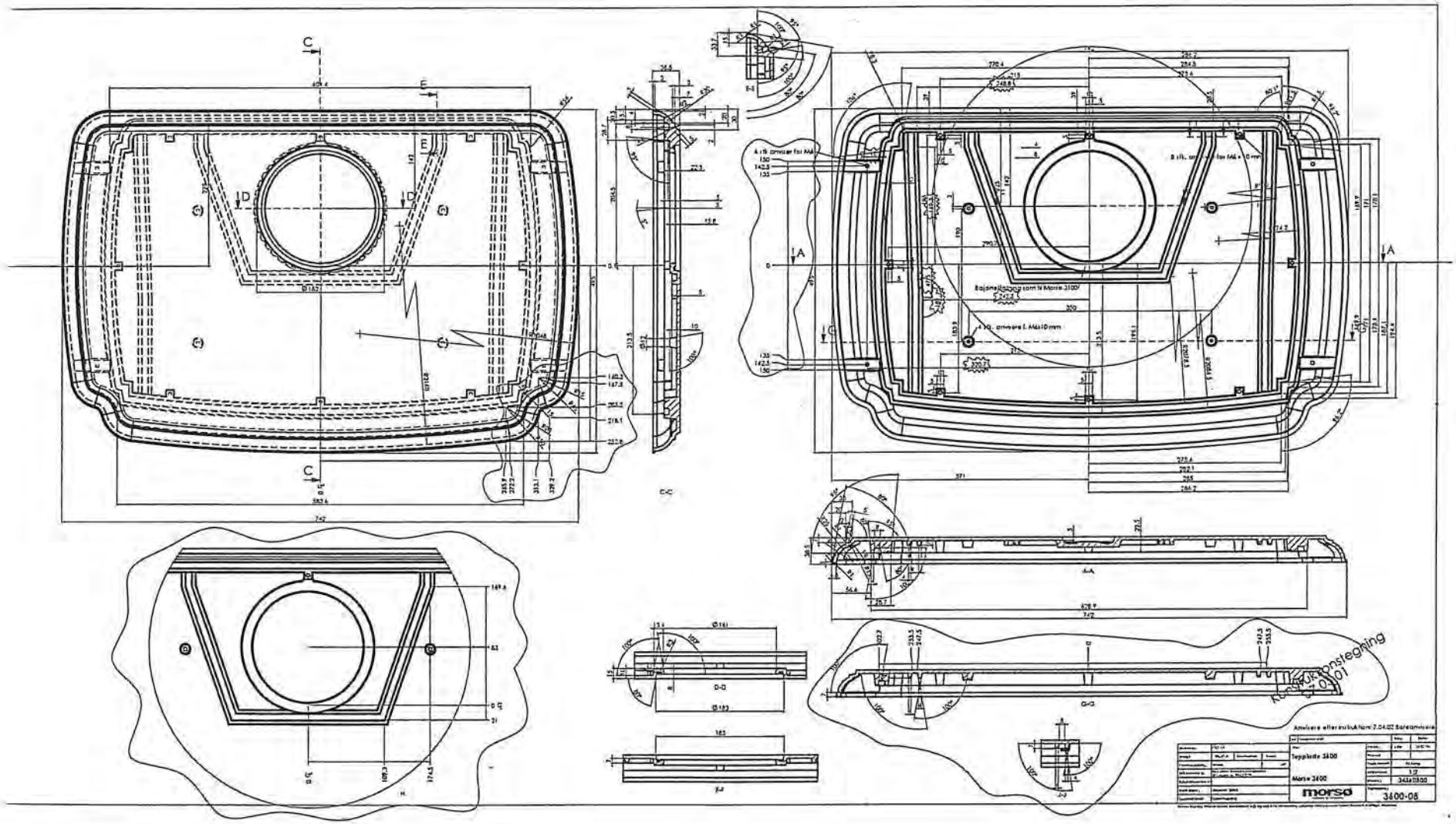

4 stk. anvisere f. M5x mm
Anviser f. ø
Anviser f. ø15
Morse navn som 2100
Mål ca 18mm høj, 77mm bred
A-A
B-B
C-C
D-D
G-G
H-H
Konstruktionstegning
20.02.01
Fyrder højre 3600
Mone 3600
morsø
3600-03
1:2

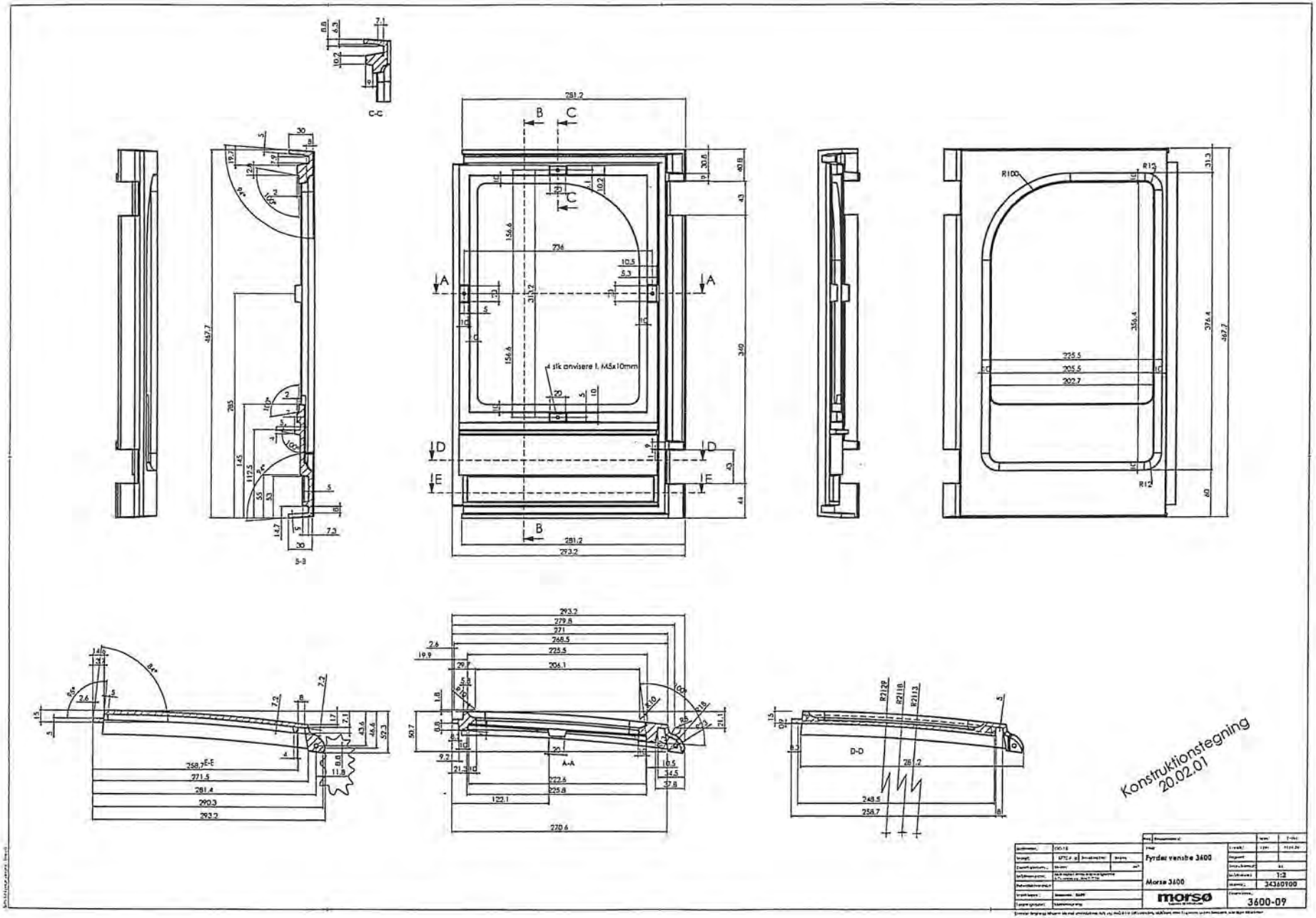

2 stk. anvisere f. Mål8mm
C-C
D-D
A-A
B-B
E (2:1)
Anvisere efter instruktio: 7.04.02 Boreanvisere
Sideplade 3600
Morse 3600
morsø
1:2
34360400
3600-04 a

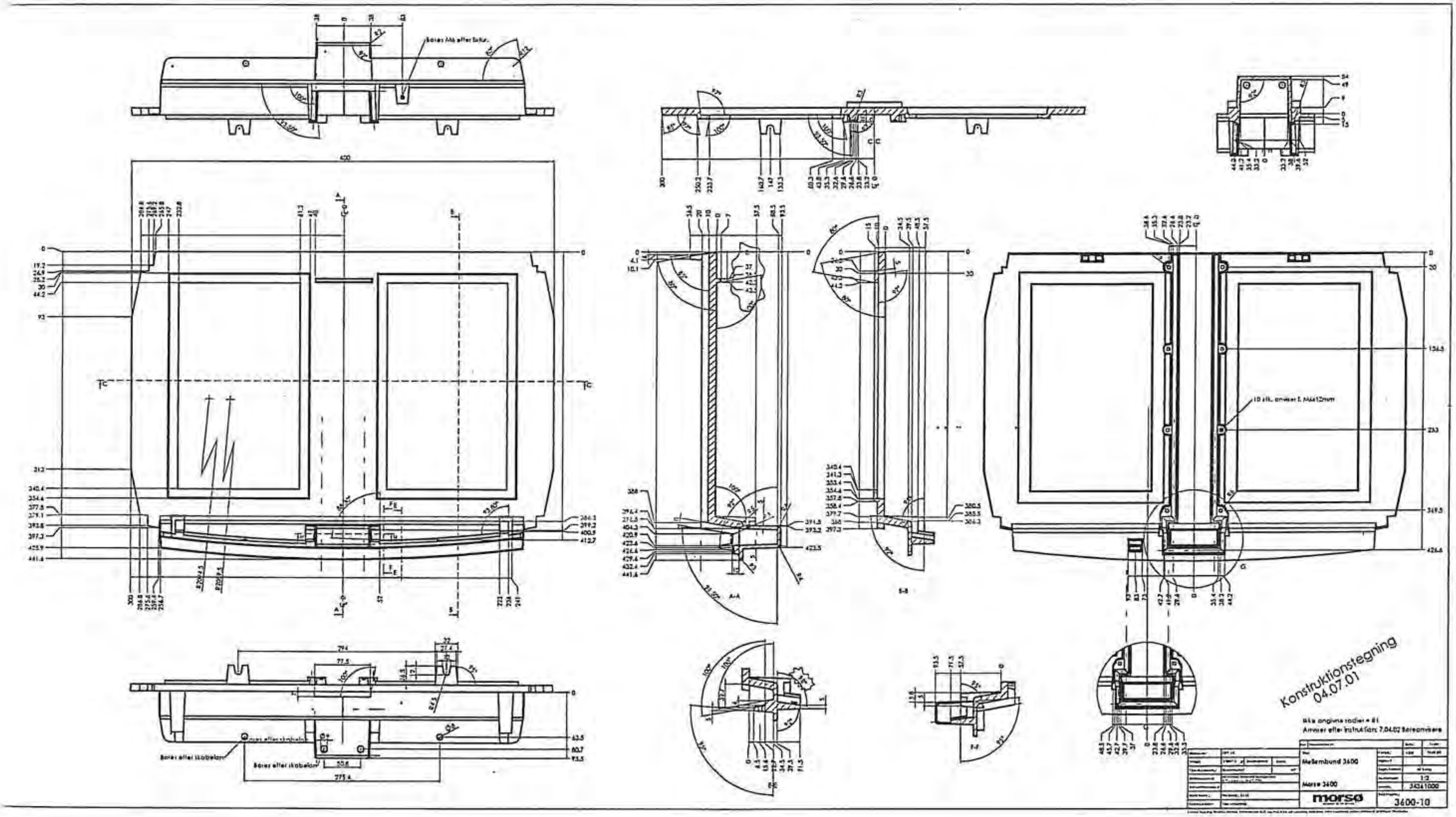

Låseanordning sampå Morsø 3400, skal vendes både for over- og forneden.
C-C
D-D
A-A
B-B
E-E
Ø12
Ikke angivne radier = R1
Anvisere eller instruktion: 7.04.02 Boreanvisere
Sideramme 3400
Morsø 3400
morsø
3600-05 a
1:2
343010500

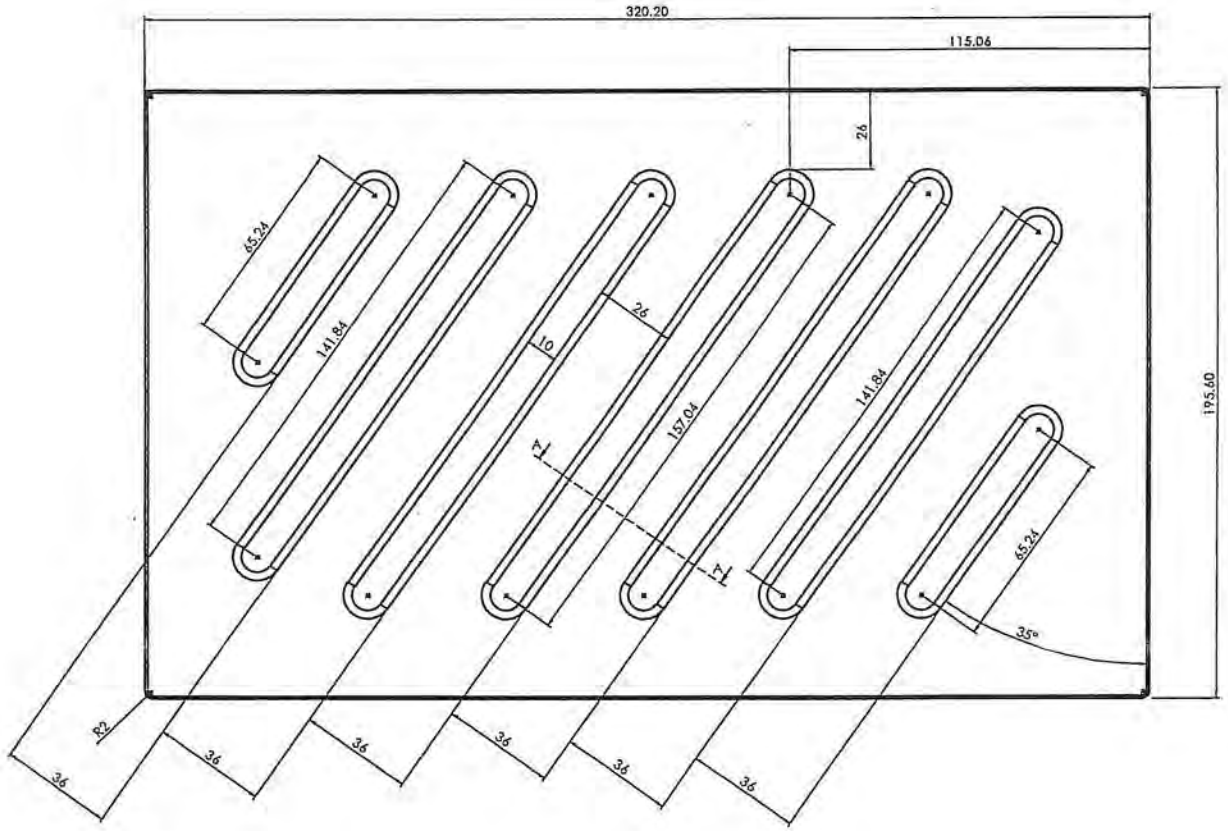

2 stk anvisere f. Mâx. Ømm
Anviser for ø15 på begge sider
C-C
H (2 : 1)
D-D
E-E
A-A
B-B
Anvisere eller instruktion: 7.04.02 Boreanvisere
Sideder 3600
Morse 3600
morsø
1:2
34360600
3600-06 a

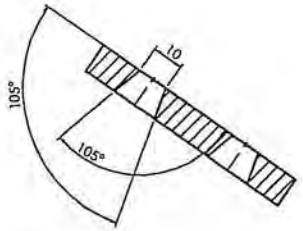

2 stk. anvisere f. M6
TRUE R10
2 stk anvisere f. M6x10mm
2 stk. anvisere f. M6
2 stk. Anviser fjernes
2 stk. Knaster fjernes
Konstruktionstegning
04.07.01
Anviser efter installation: 7.04.02 Boreanvisere
Bagplade 3600
Marin 3600
morsø
3600-07
1:2


Teppelokk 3400
Morsø 3400
morsø
3400-05


C-C
B-B
A-A
D-D
E-E
4 stk anvisere f. M5x10mm
Konstruktionstegning
20.02.01
Fyrdør venstre 3600
Morsø 3600
morsø
3600-09
24360900
1:2


Konstruktionstegning
04.07.01
Mellembund 3600
Morsø 3600
1:2
34341000
morsø
3600-10
Bores efter skabelon
A-A
B-B
E-E
F-F

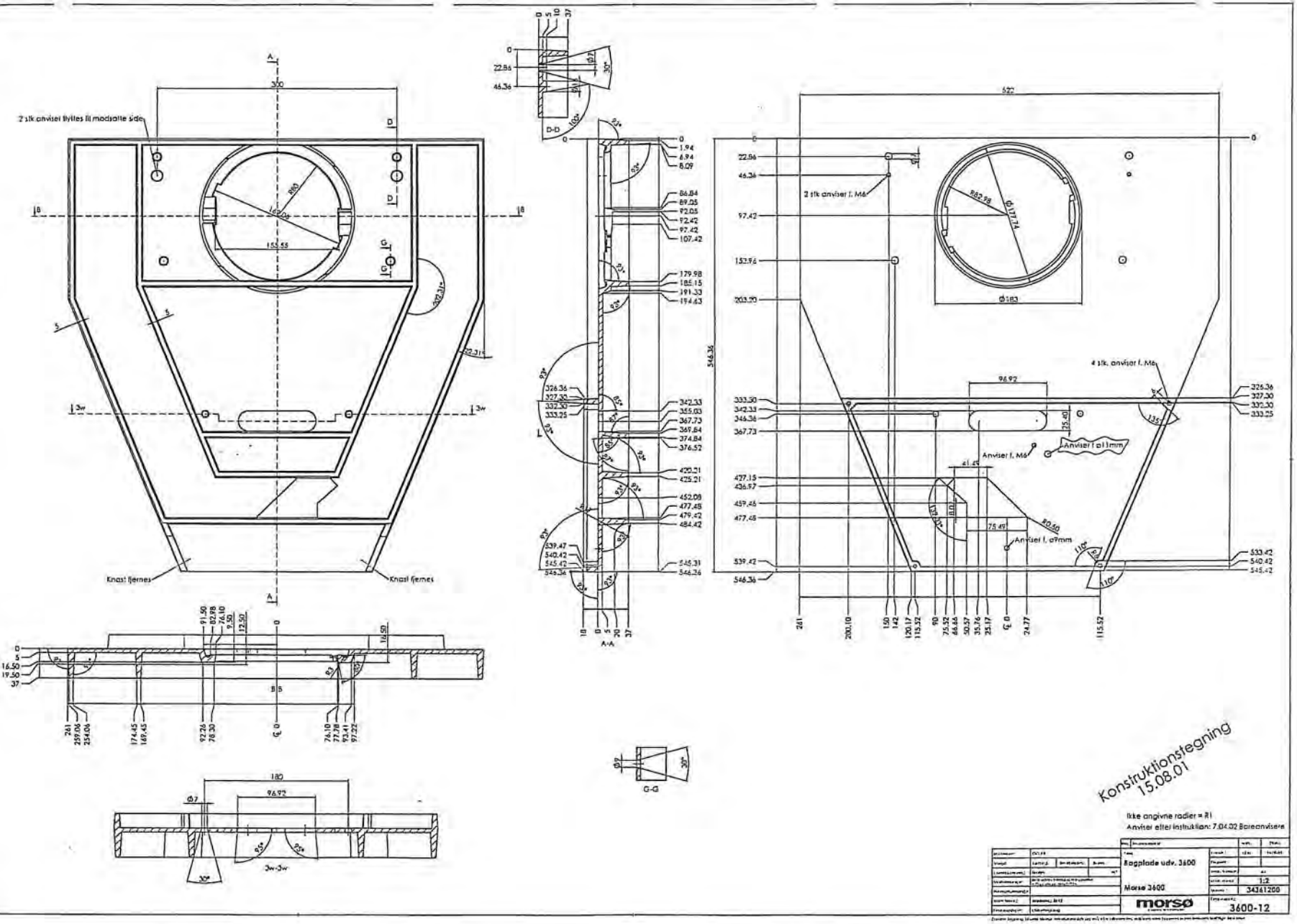


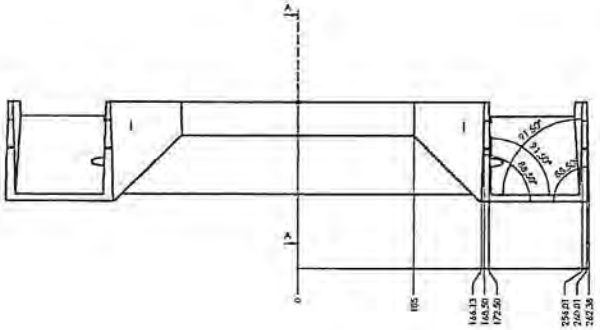


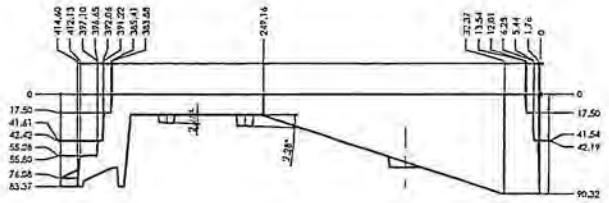
A-A

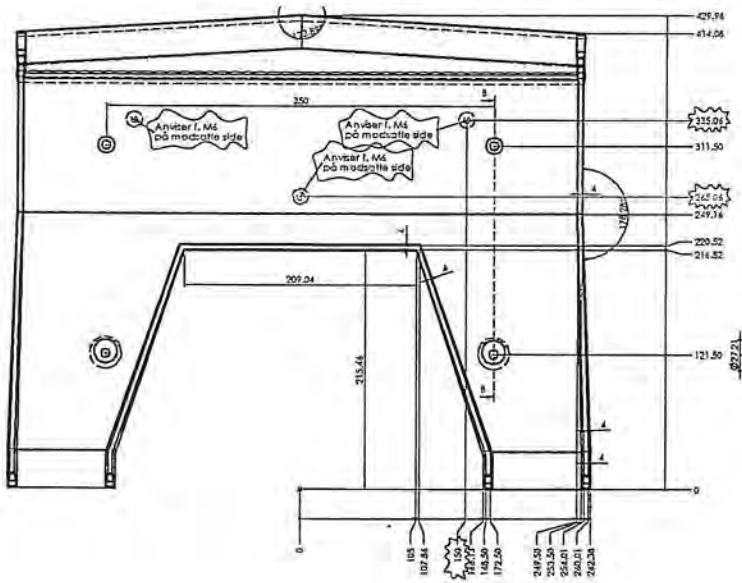
Konstruktionstegning
16.05.01

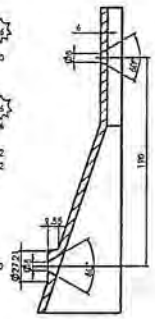
Materiale:	GG 15			Rev.	Revisionstekst:	Sign.:	Dato:
Vægt:	5431.1 g	Restbejdset	Nej	Titel:	Rist 3600	Konstr.:	EDU 14.05.01
Overfladebeh.:	Ubehandlet		m²			Tegnet:	
Måltolerancer:	ISO-norm nr. 8062 CT8					Tegnformat:	A2
Rundstolerancer:					Morsø 3600	Målforhold:	1:1
Varetypenr.:	Modelnr. 3411					Varenr.:	34361100
Tegningstype:	Støbetegning			morsø		Tegningsnr.:	3600-11

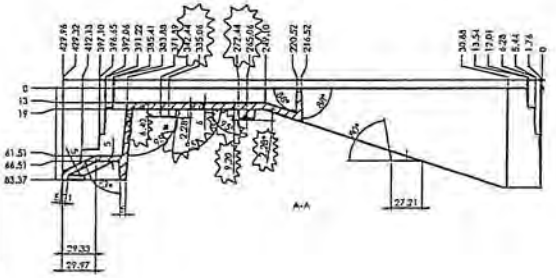

2 stk anviser flyttes til modsatte side
Knast fjernes
Knast fjernes
A-A
B-B
C-C
D-D
E-E
F-F
G-G
2 stk anviser f. M6
4 stk. anviser f. M6
Anviser f. M6
Anviser f. ø11mm
Anviser f. ø9mm
Konstruktionstegning
15.08.01
Ikke angivne radier = R1
Anviser efter instruktion: 7.04.02 Boreanvisere
Bagplade udv. 3600
Morsø 3600
morsø
3600-12
34361200
1:2





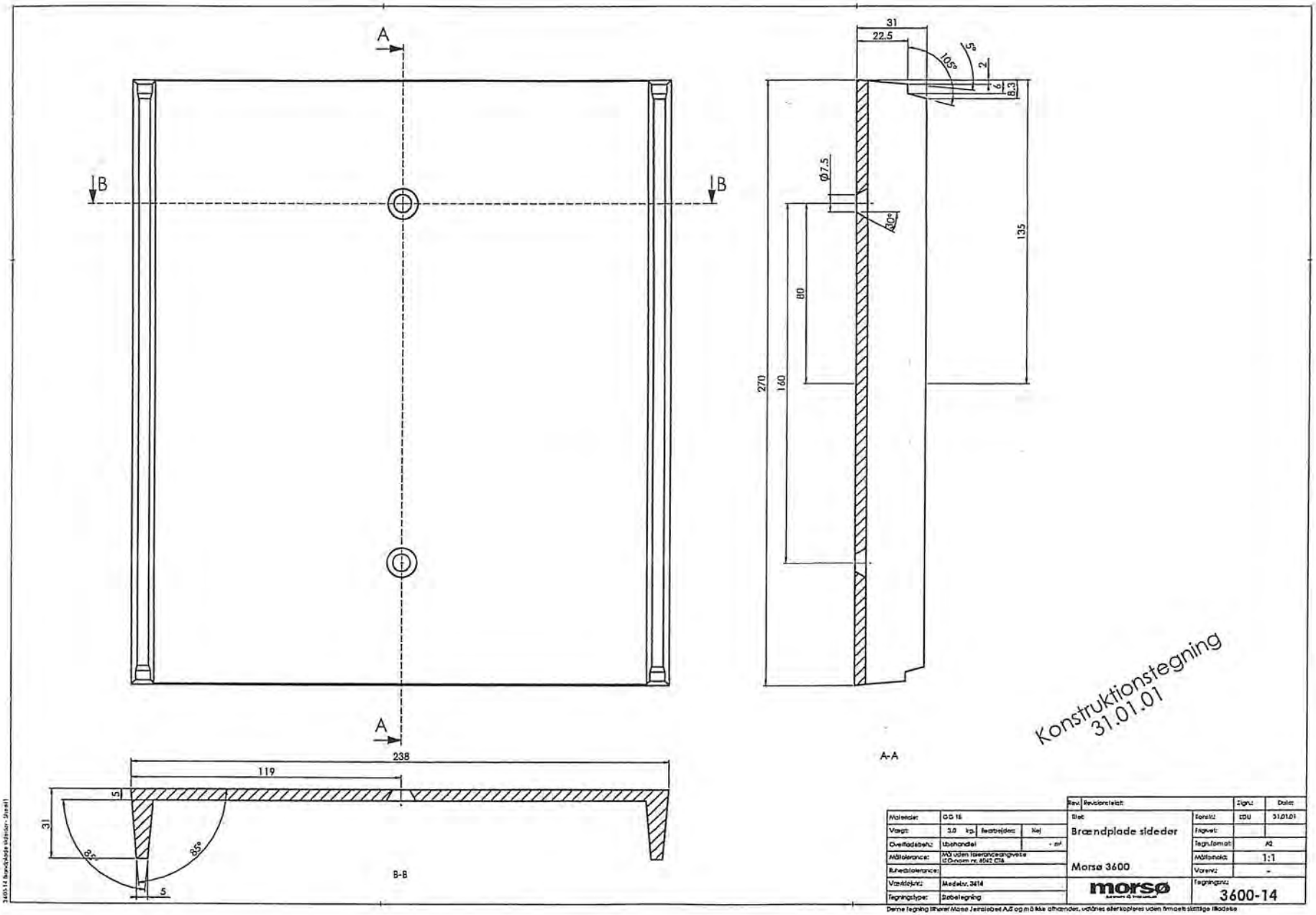






Konstruktionstegning
19.06.01

	Tagplade indvendig 3600		
	Mono 3600	1:25	
	morsø	34361300	
		3600-13	



Konstruktionstegning
31.01.01

				Rev.	Revisionstekst:	Sign:	Dato:
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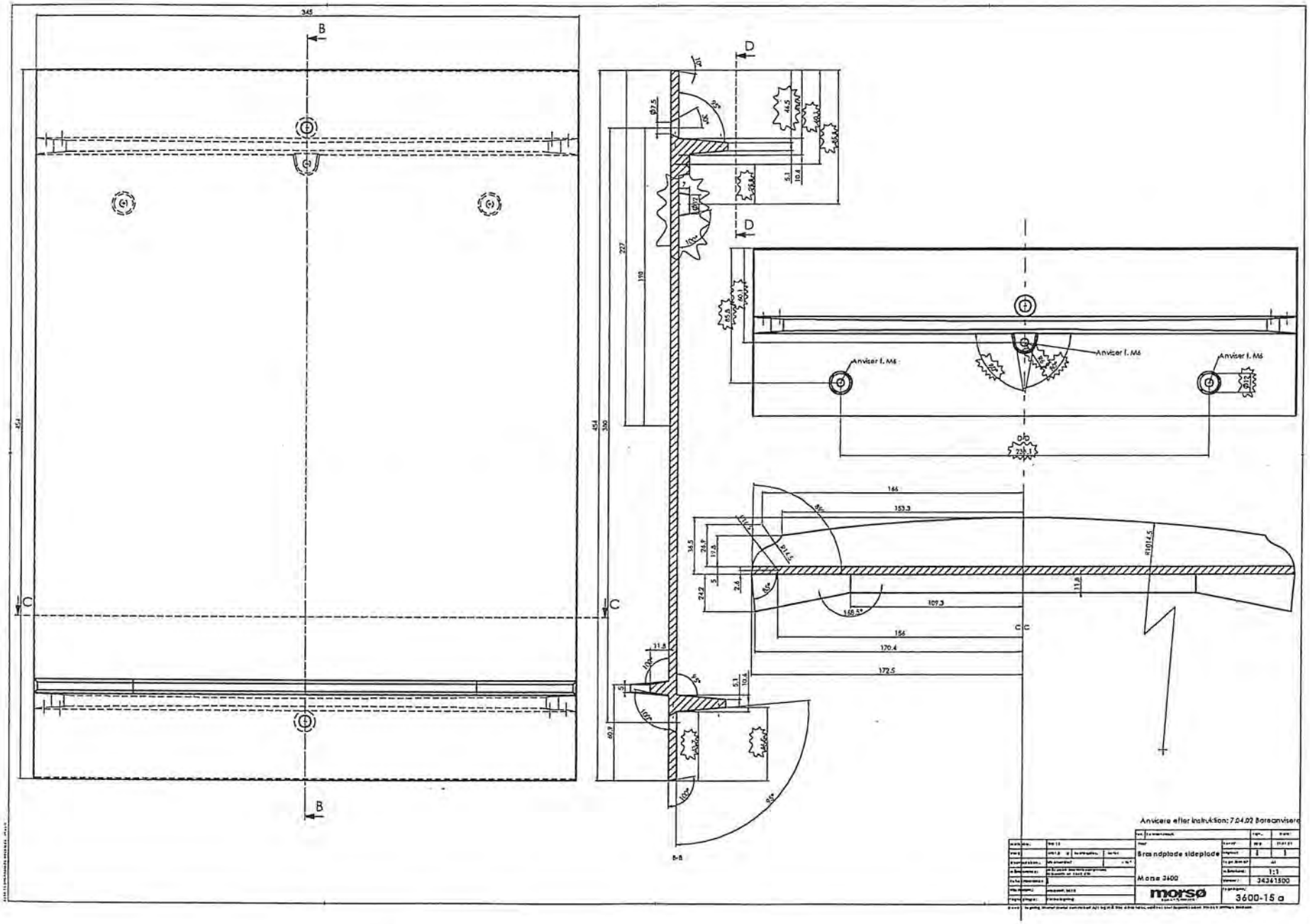
Vægt:	3.0 kg.	Beatbejdes:	Nej			Tegnet:	
Overfladebeh.:	Ubehandlet		- m²			Tegnformat:	A2
Målotolerance:	ISO 8062 CT8				Morsø 3600	Målestok:	1:1
Rihedstolerance:						Varenr.:	-
Værktøjnr.:	Modelnr. 3414			morsø		Tegningsnr.:	3600-14
Tegningstype:	Støbetegning						

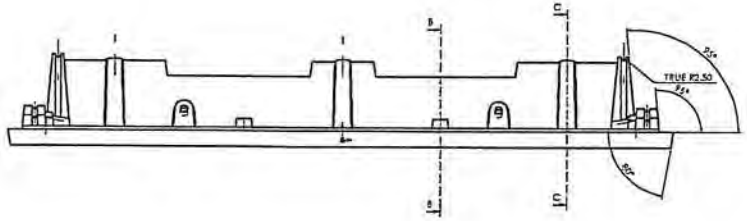
Denne tegning tilhører Morsø Jernstøberi A/S og må ikke afhændes, udlånes eller kopieres uden firmaets skriftlige tilladelse

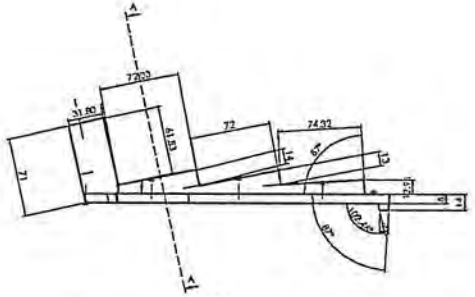
3600-14 Brændplade sidedør - Støbell

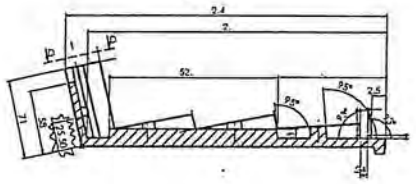


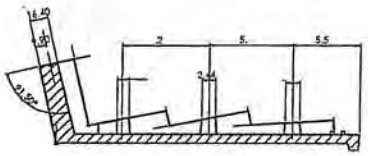
Anvisere efter instruktion: 7.04.02 Boreanvisere

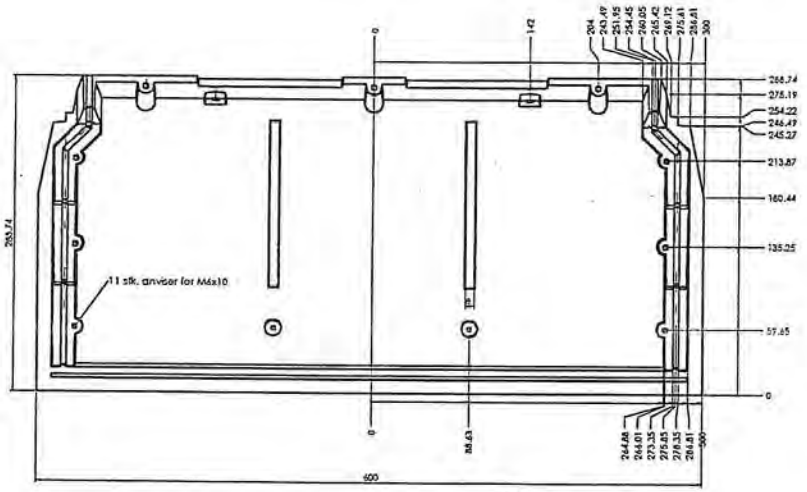
Brandplade sideplade			
Mobile 3600			1:1
morsø			34361500
			3600-15 a

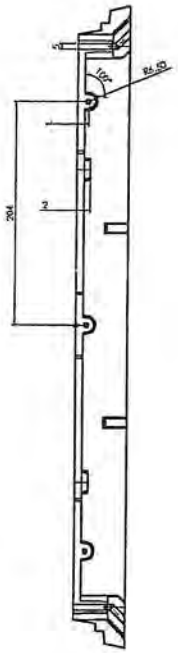




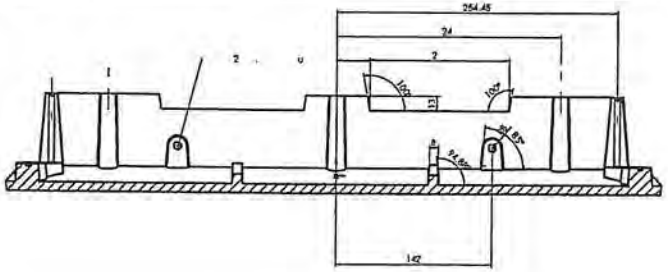






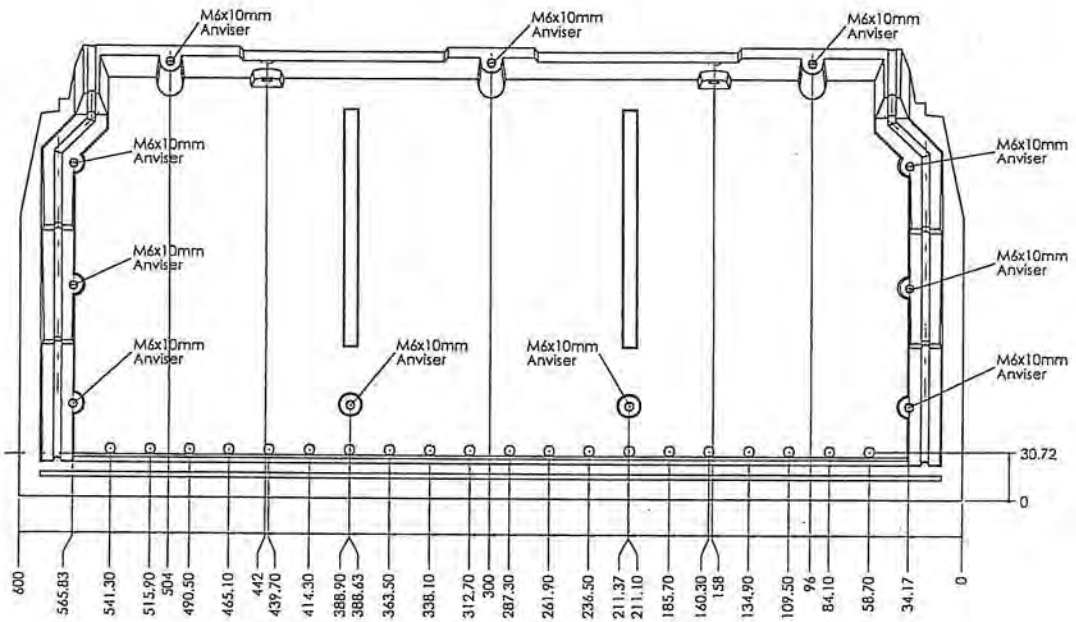


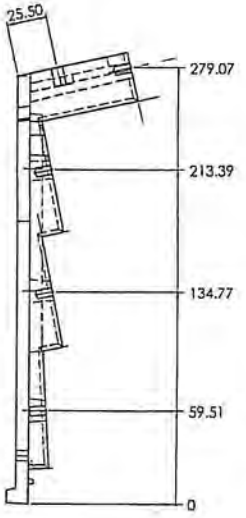
D-D

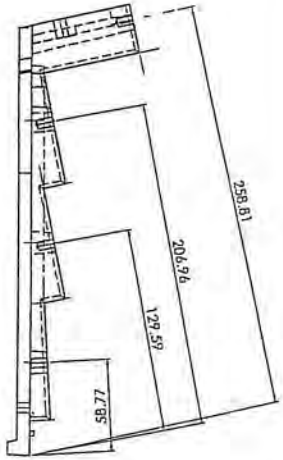


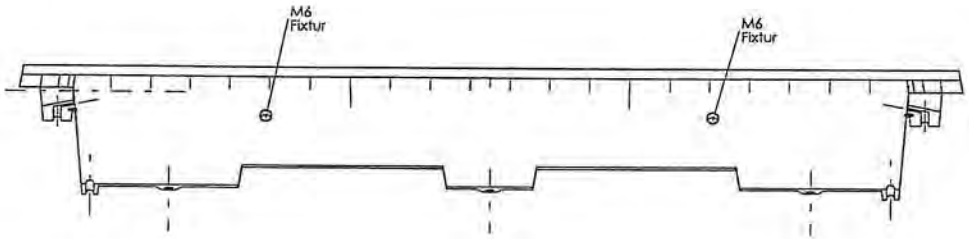
Konstruktionstegning
18.05.01

		Ragledeplade 3600	
		Mono 3600	1:2
		morsø	24361600
			3600-16

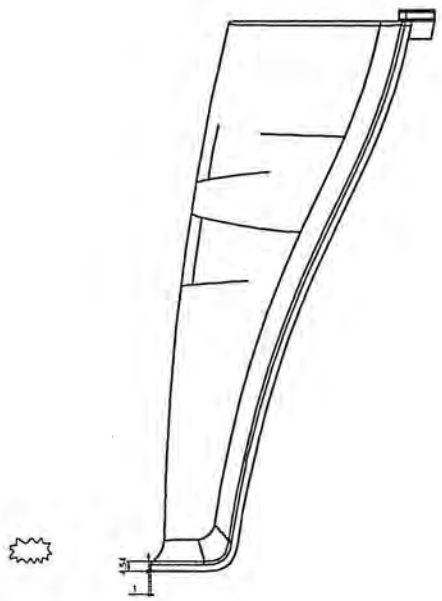


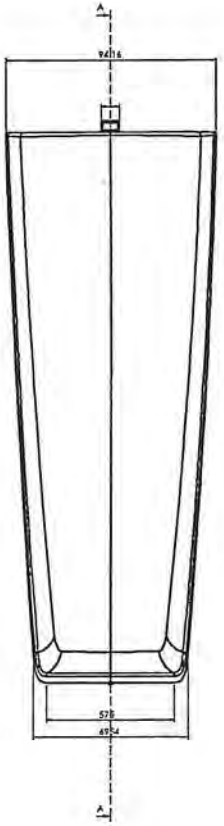


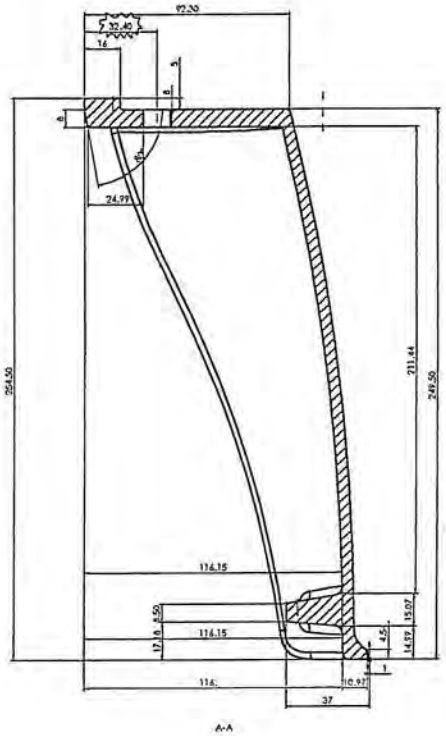


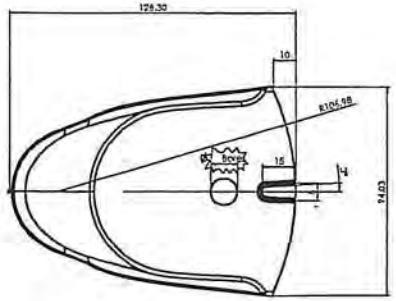


Rev	Revisionstekst:					Sign:	Dato:
Materiale:	GG 15			Titel:		Fornr:	5DU 18.07.01
Vægt:	1271.8 kg	Bearbejdes:	Bores	Røgledeplade 3600		Filpvej:	
Overfladebeh.:	Ubehandlet		m²	Bearbejdet		Tegnformat:	A2
Måltolerance:	Mål uden tolerancesangivelse			Morsø 3600		Målforhold:	1:2
Ruhedstolerance:						Varenr.:	-
Værktøjnr.:	Maskinr. 3616			morsø		Tegningsnr.:	44361600 a
Tegningstype:	Bearbejdningstegning						



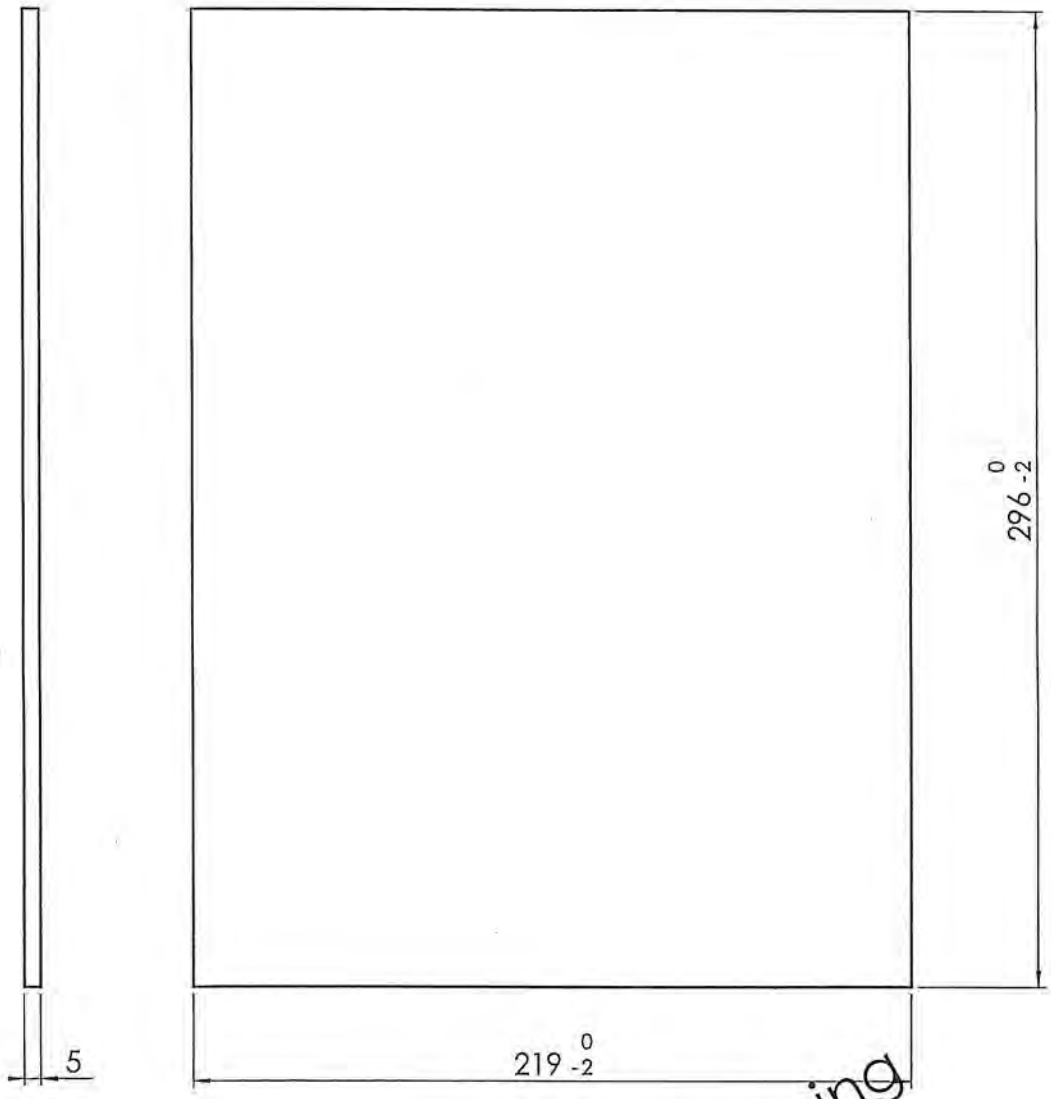






Konstruktionstegning
07.05.01

Ben 3600			
Mona 3600			1:1
morsø			34341700
			3600-17



Konstruktionstegning
21.02.01

Rev.	Revisionstekst:	Sign.:	Dato:

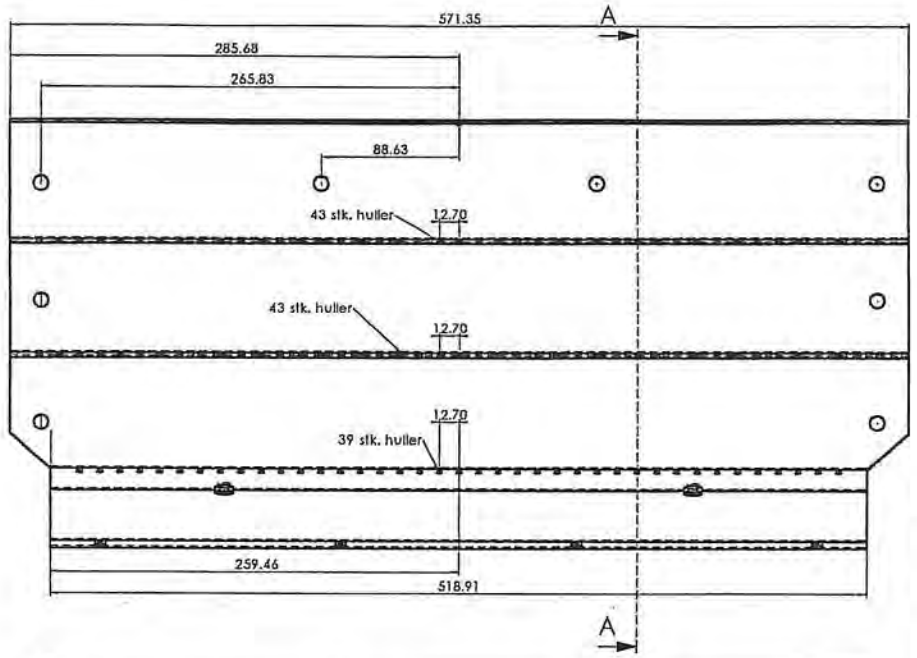
Materiale:	5mm keramisk glas			Konstr.:	KDU 21.02.01
Vægt:	813.5 g	Bearbejdes:		Frigivet:	
Overfladebeh.:			m²	Tegn.format:	A4
Måltolerance:	Se tegning			Målforhold:	1:2
Ruhedstolerance:				Varenr.:	79360000
Værktøjsnr.:				Tegningsnr.:	3600-20
Tegningstype:	Emnetegning				

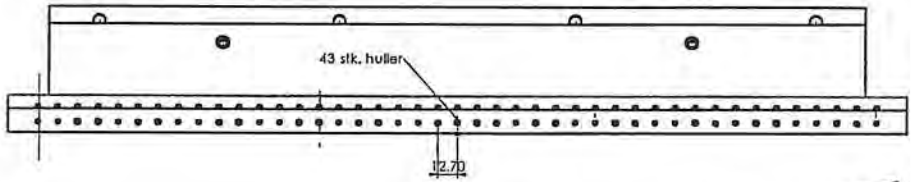
Titel: Glas 3600

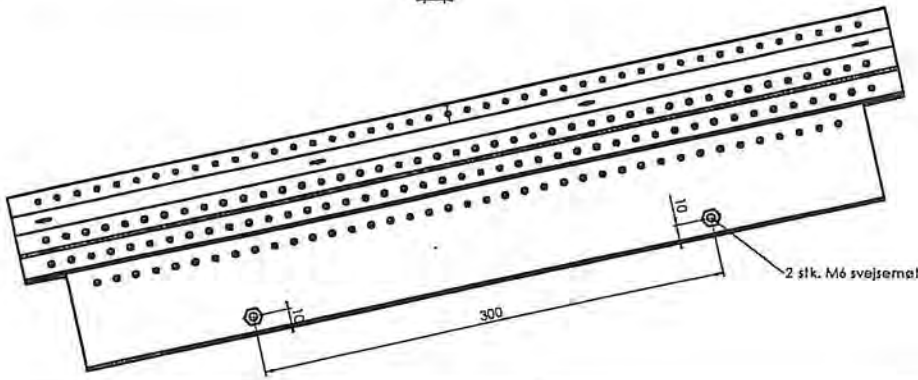
Morsø 3600

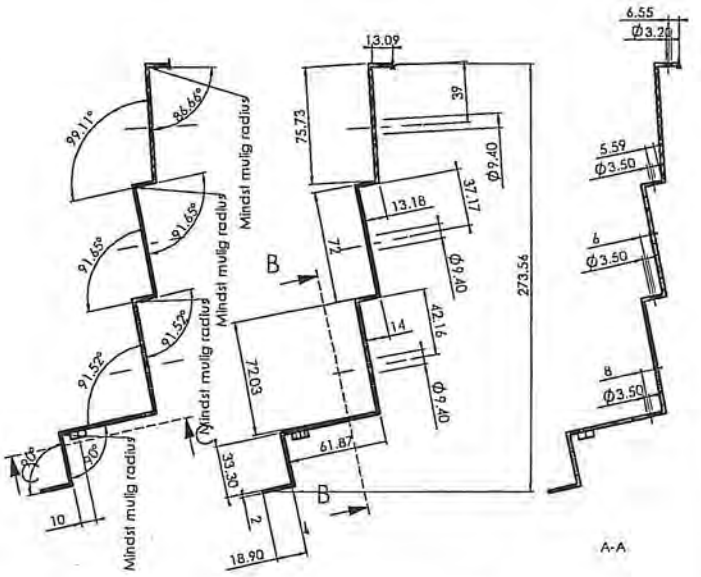
morsø

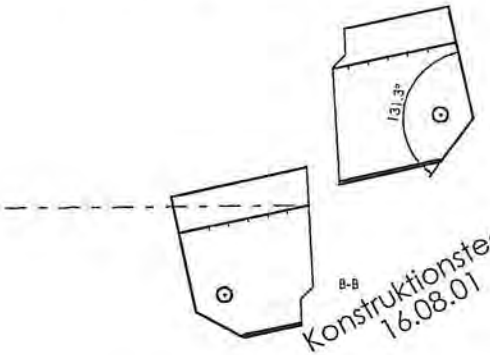
3600-20 Glas - Sheet1







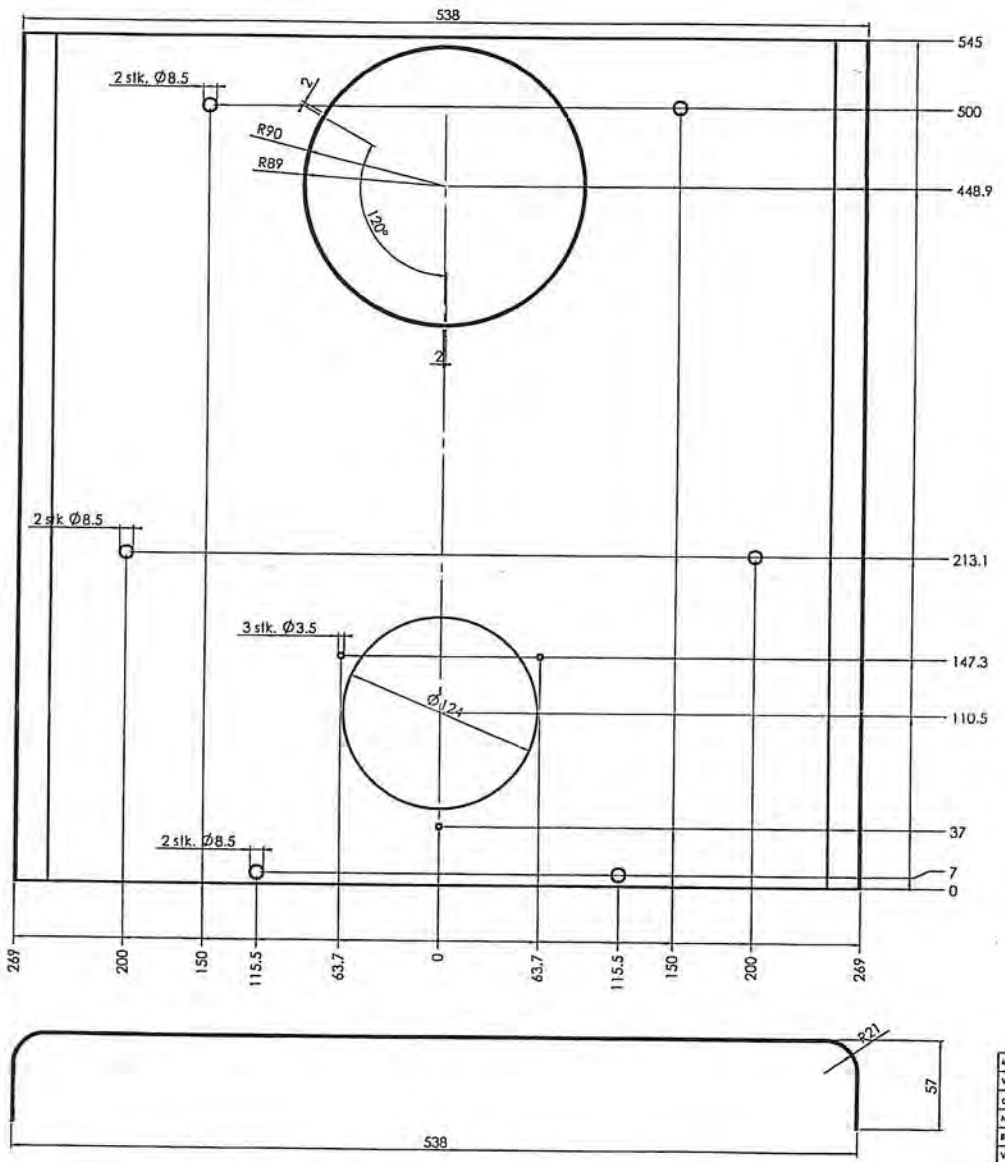


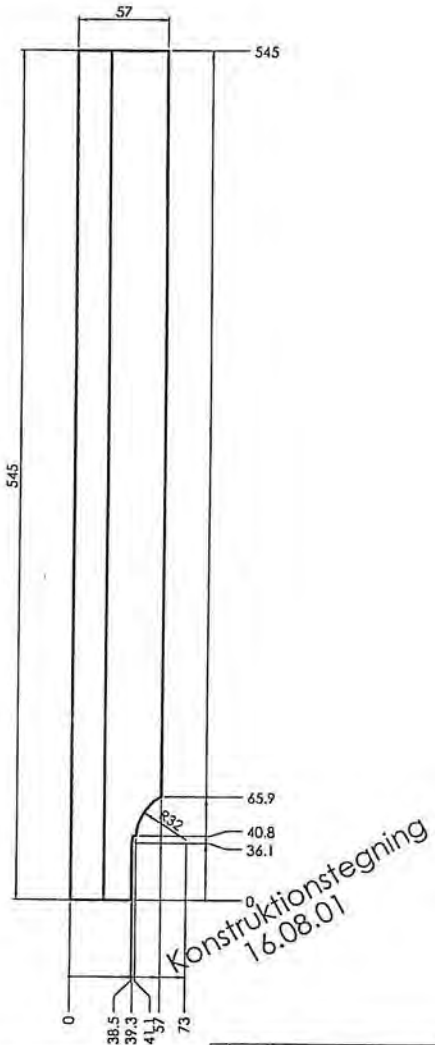


Konstruktionstegning
16.08.01

Rev.	Revisionstekst:	Sign.:	Dato:
	Titel:	Tegnet:	EDU 19.03.01
	Regledeplade rustfri	Tegnet:	
	USA version	Tegnformat:	A2
	Morsø 3600	Målestoksf.:	1:2
		Varenr.:	71360161
	morsø	Tegningsnr.:	3600-21

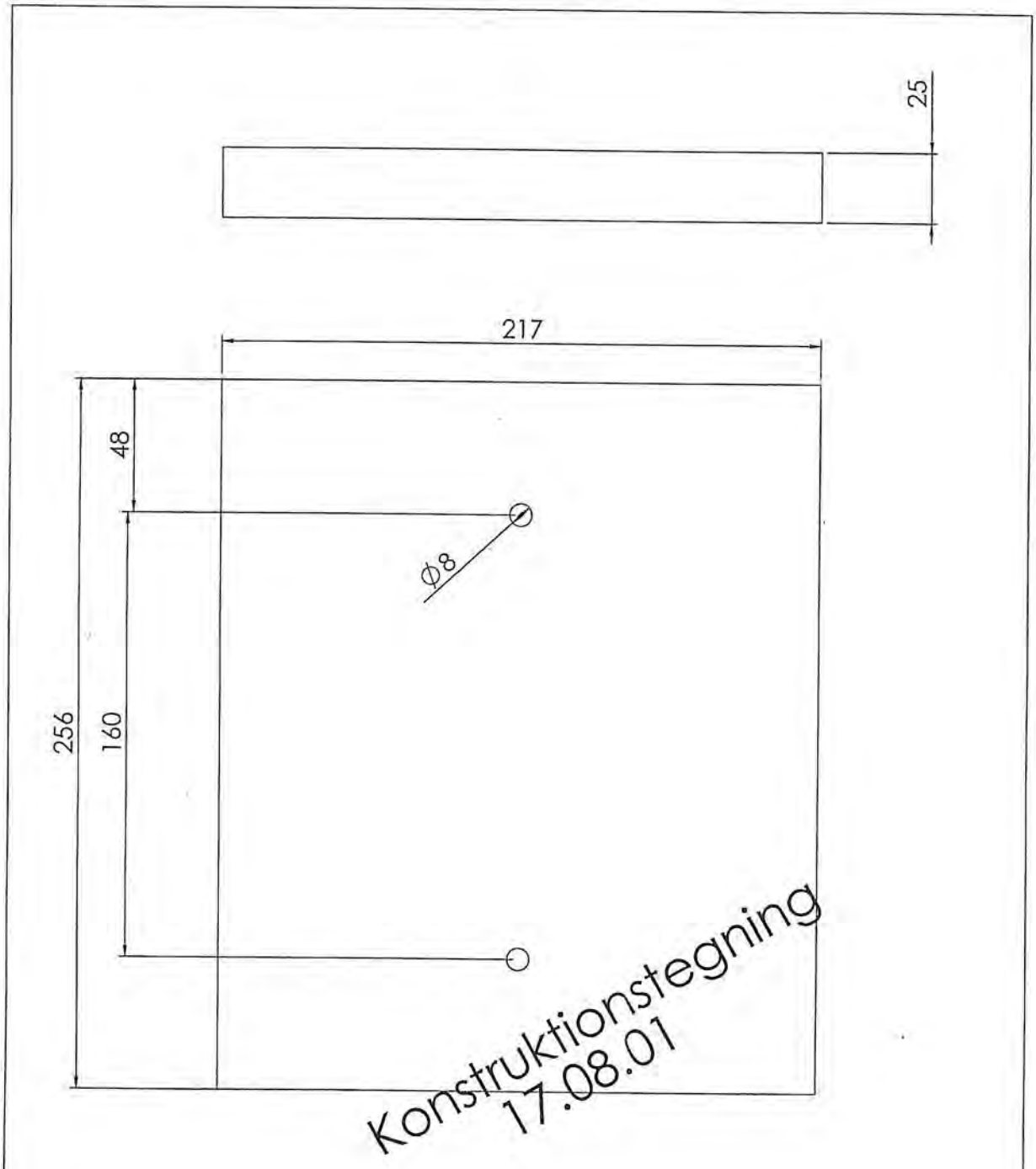
Materiale:	2mm rustfri stål - AISI 304
Vægt:	3237.2 g Overbejdes:
Overfladebeh.:	Ubehandlet nr
Måltolerance:	Må uden toleranceangivelse DS/ISO 2768-1 m
Rihedstolerance:	
Varmebehandl.:	
Tegningstype:	Emnetegning





Konstruktionstegning
16.08.01

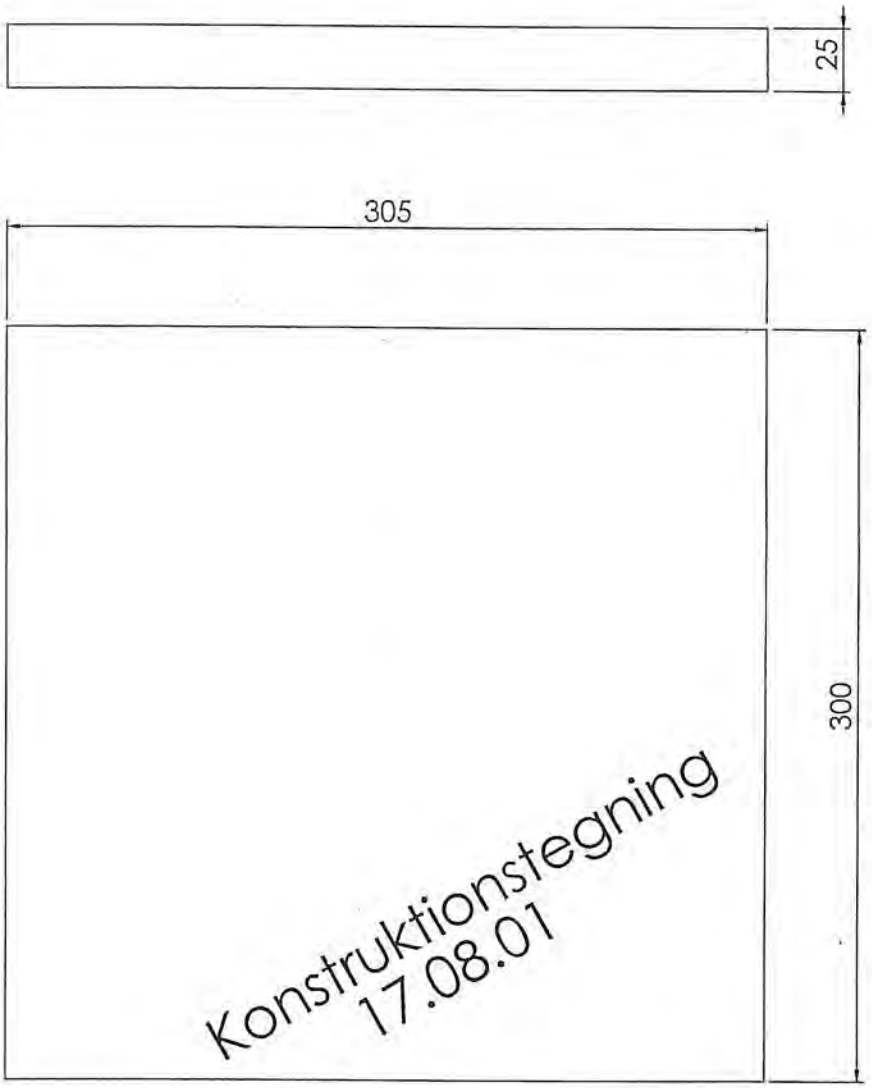
Materiale:	1mm galvaniseret plade			Rev	Revisionsliste	Sign:	Dato:
Vægt:	2292.0 g	Bearbejdes:	Bores/bukkes	Titel	Konstr:	RSV	27.02.2001
Overfladebeh.:	Males		m²	Stråleskærm bag	Tegnet:		
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m				Tegn.format:	A2	
Ruhedstolerance:				Morsø 3600	Måleforhold:	1:2	
Værktøjsnr.:					Varenr.:	71360200	
Tegningstype:	Emnetegning			morsø	Tegningsnr.:	3600-22	



Konstruktionstegning
17.08.01

				Rev.	Revisionstekst:	Sign.:	Dato:
Materiale:	25mm Isoleringsmåtte			Titel:		Konstr.:	KDU 05.07.01
Vægt:	- g	Bearbejdes:	Nej	**Isoleringsmåtte sidedør**		Frigivet:	
Overfladebeh.:	Ubehandlet		- m²			Tegn.format:	A4
Måltolerance:	Se tegning					Målforhold:	1:2
Ruhedstolerance:				**Morsø 3600**		Varenr.:	79074900
Værktøjsnr.:	-			morsø		Tegningsnr.:	3600-23
Tegningstype:	Emnetegning						

3600-23 Sidesten sidedør - Sheet1



Rev.	Revisionstekst:	Sign.:	Dato:

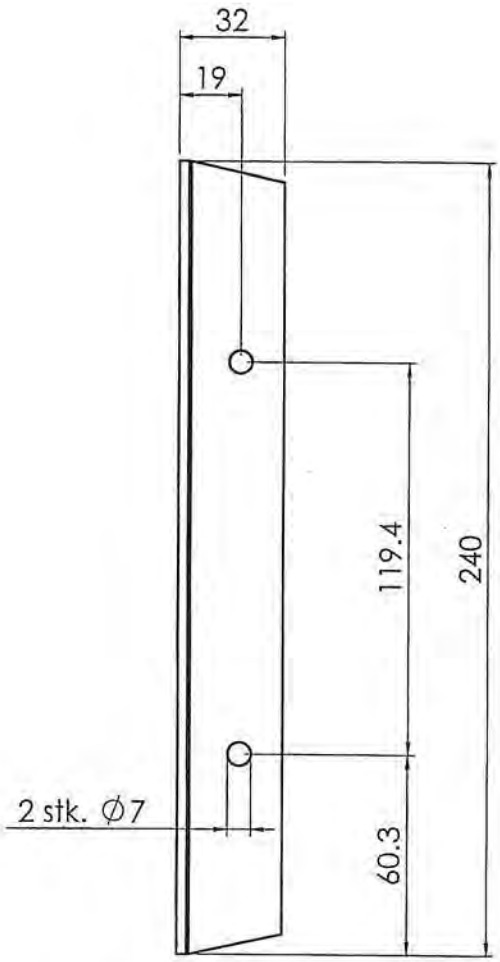
Materiale:	25mm Isoleringsmåtte			Konstr.:	KDU 05.07.01
Vægt:	- g	Bearbejdes:	Nej	Tegivet:	
Overfladebeh.:	Ubehandlet		- m²	Tegn.format:	A4
Måltolerance:	Se tegning			Målforhold:	1:2.5
Ruhedstolerance:				Varenr.:	79075000
Værktøjsnr.:	-			Tegningsnr.:	3600-24
Tegningstype:	Emnetegning				

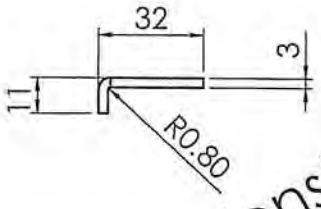
Titel: **Isoleringsmåtte sideplade**

Morsø 3600

morsø

3600-24 Sten sideplade - Sheet1





Konstruktionstegning
26.06.01

Rev.	Revisionstekst:	Sign.:	Dato:

Materiale:	3mm rustfri stål - AISI 304		
Vægt:	214.8 g	Bearbejdes:	Buk/bor
Overfladebeh.:	Ubehandlet		- m²
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m		
Ruhedstolerance:			
Værktøjsnr.:	-		
Tegningstype:	Emnetegning		

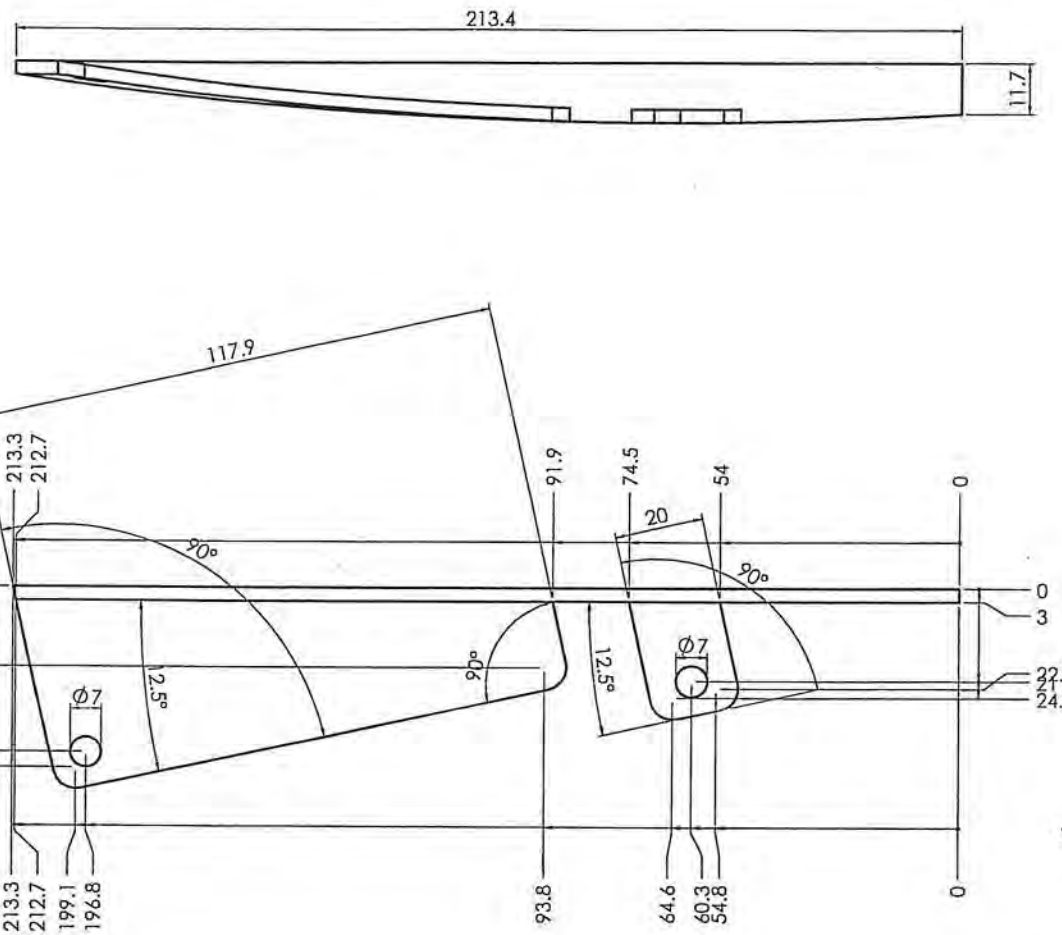
Titel:
Vinkelbeslag røgledepl. ved brændplade Morsø 3600

Konstr.:	KDU 26.06.01
Frigivet:	
Tegn.format:	A4
Målforhold:	1:2
Varenr.:	71360361

morsø
By appointment to HM the Royal Danish Court

Tegningsnr.: **3600-25**

3600-25 Rustfri vinkelbeslag - Sheet1



Konstruktionstegning
05.07.01

Rev.	Revisionstekst:	Sign.:	Dato:
		KDU	26.06.01

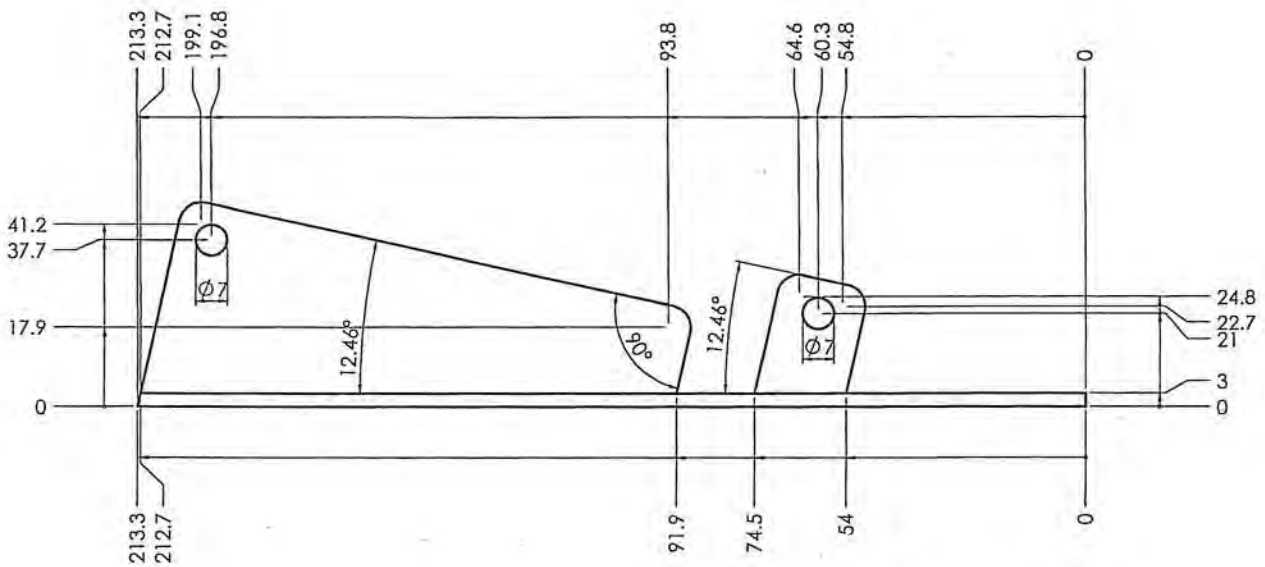
Materiale:	3mm rustfri stål - AISI 304		
Vægt:	156.2 g	Bearbejdes:	svejse
Overfladebeh.:	Ubehandlet		- m²
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m		
Ruhedstolerance:			
Værktøjsnr.:	-		
Tegningstype:	Emnetegning		

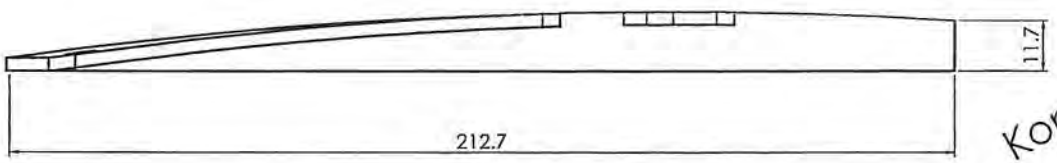
Titel:
Vinkelbeslag venstre ved siderамme Morsø 3600

Konstr.:	KDU
Frigivet:	
Tegn.format:	A3
Målforhold:	1:1
Varenr.:	71360461
Tegningsnr.:	3600-26

morsø

3600-26 Vinkelbeslag venstre siderамme - Sheet1

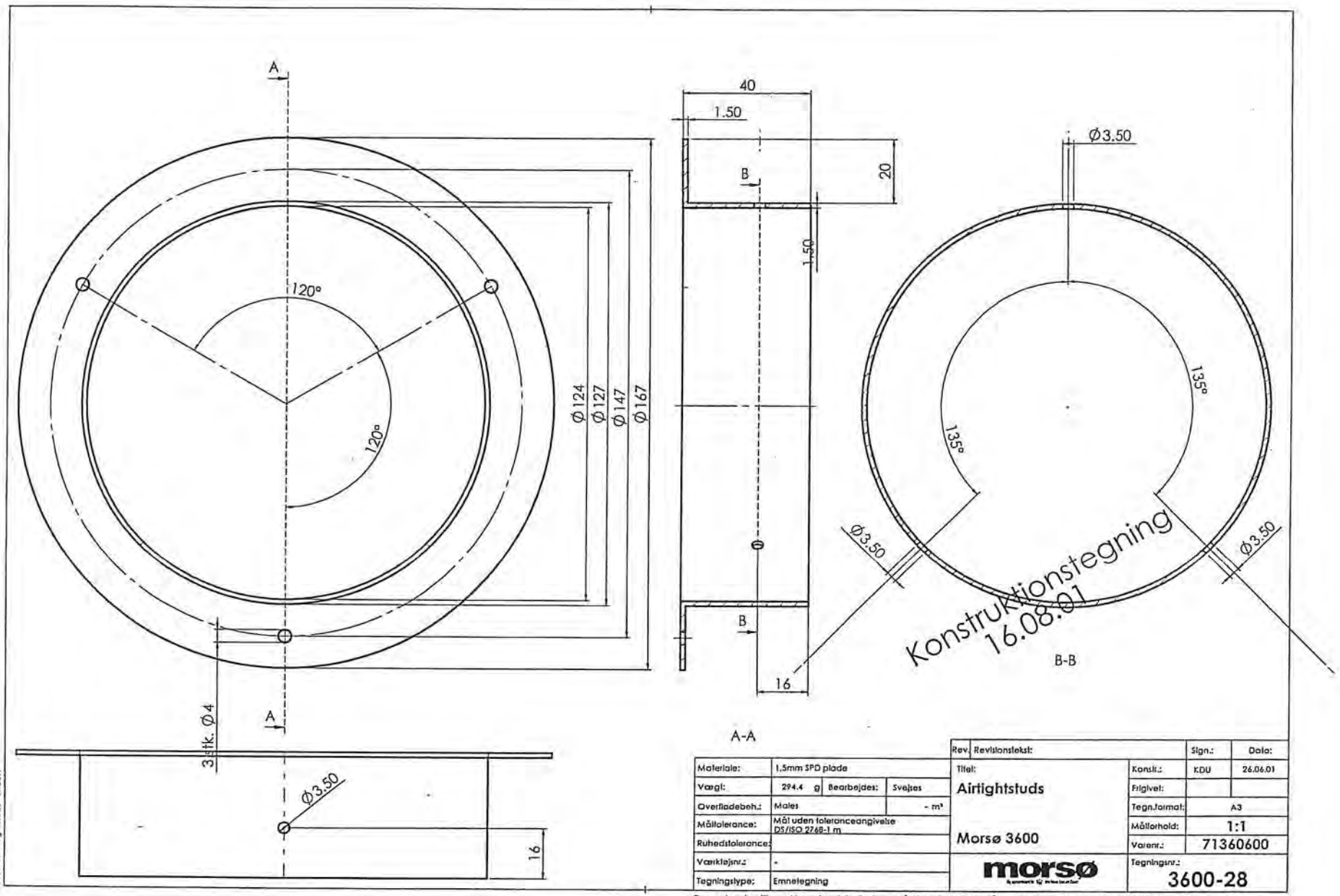




Konstruktionstegning
05.07.01

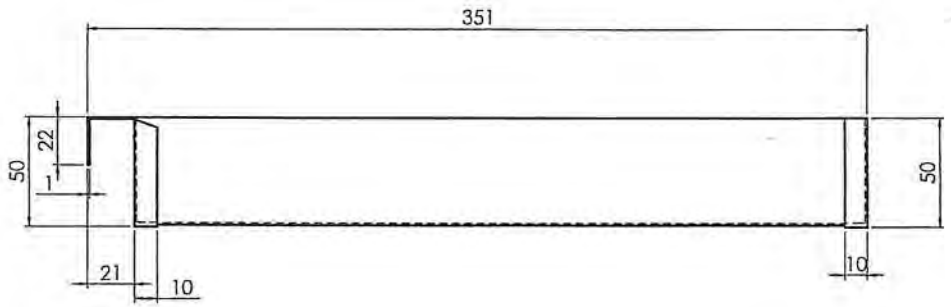
Rev.	Revisionstekst:	Sign.:	Dato:

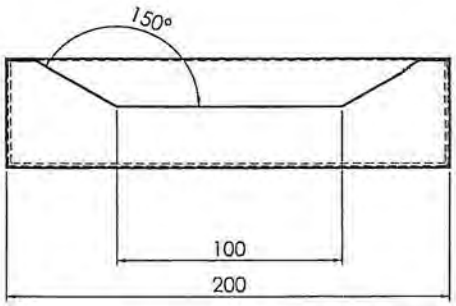
Materiale:	3mm rustfri stål - AISI 304			Titel: Vinkelbeslag højre ved siderramme Morsø 3600	Konstr.: KDU 26.06.01
Vægt:	156.2 g	Bearbejdes:	svejse		Frigivet:
Overfladebeh.:	Ubehandlet		- m²		Tegn.format: A3
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m				Målforhold: 1:1
Ruhedstolerance:					Varenr.: 71360561
Værktøjsnr.:	-			morsø	Tegningsnr.: 3600-27
Tegningstype:	Emnetegning				

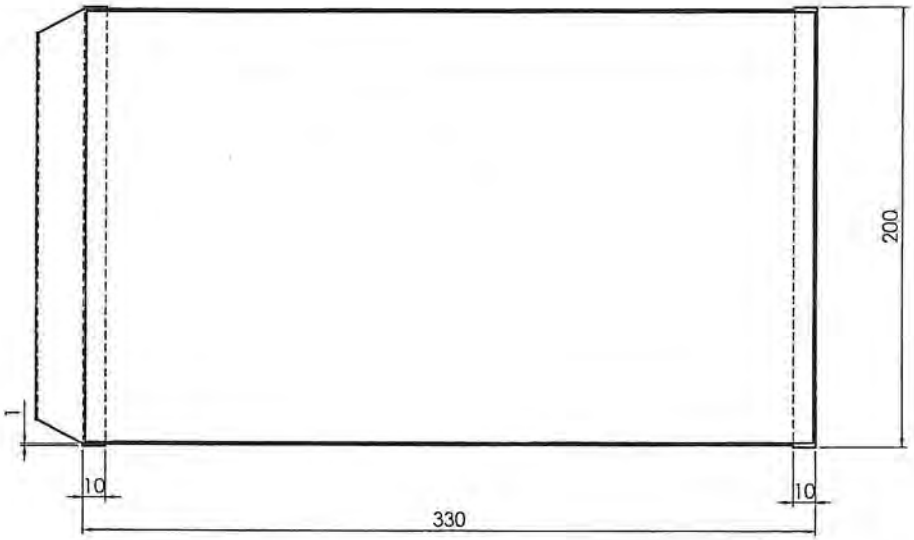


Materiale:	1,5mm SPD plade		
Vægt:	294.4 g	Bearbejdes:	Svejses
Overfladebeh.:	Males		- m²
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m		
Ruhedstolerance:			
Værktøjsnr.:	-		
Tegningstype:	Emnetegning		

Rev.	Revisionstekst:	Sign.:	Dato:
Titel:	Airtightstuds	Konstr.:	KDU 26.06.01
		Frigivet:	
		Tegn.format:	A3
		Målforhold:	1:1
	Morsø 3600	Varenr.:	71360600
	morsø	Tegningsnr.:	3600-28





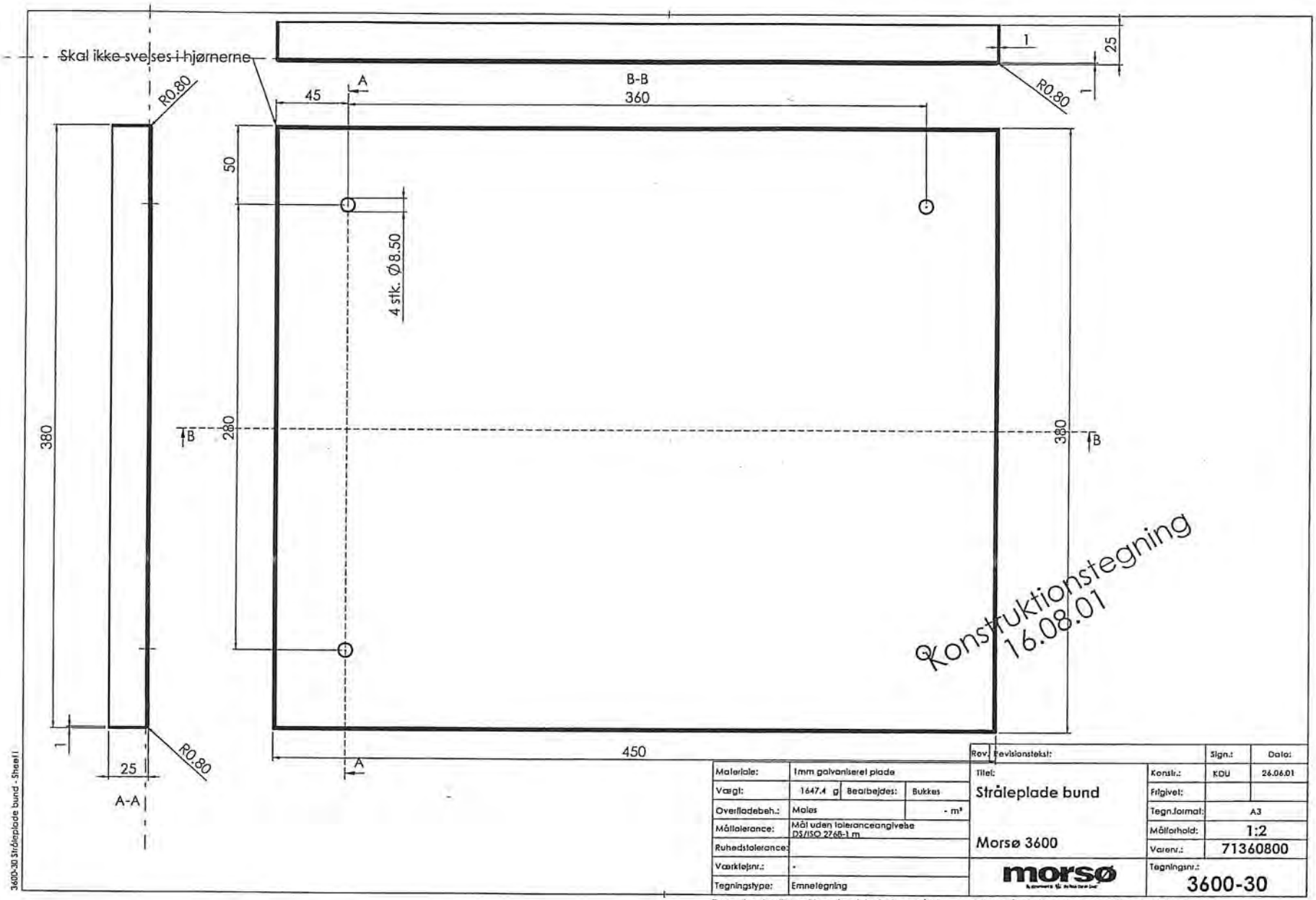


Konstruktionstegning
26.06.01

Rev.	Revisionstekst:	Sign.:	Dato:

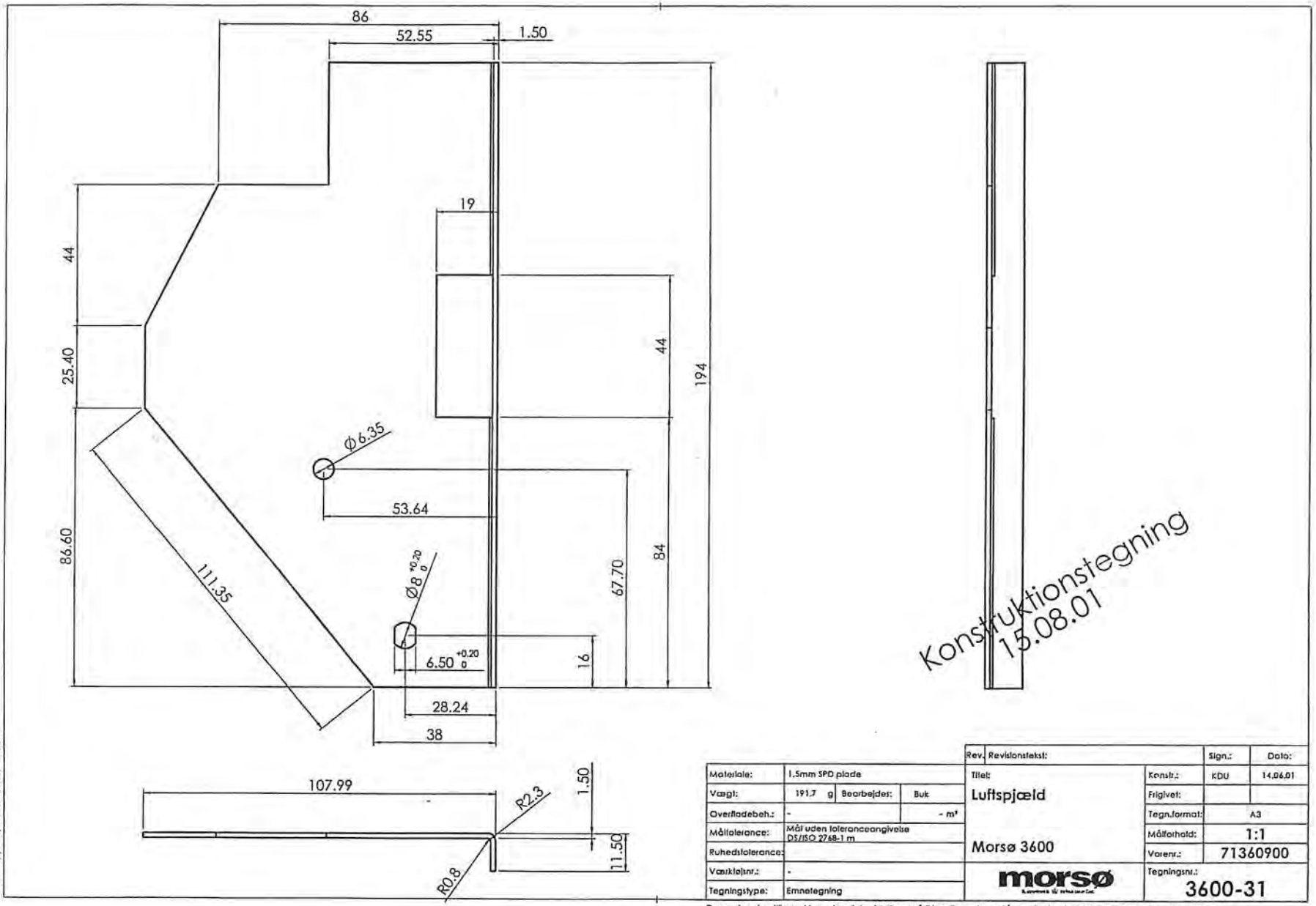
Materiale:	1mm SPD plade			Titel: Askeskuffe 3600	Konstr.: KDU 26.06.01
Vægt:	1010.2 g	Bearbejdes:	Buk/Svejs		Frigivet:
Overfladebeh.:	Ubehandlet		- m²		Tegn.format: A3
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m				Målforhdd: 1:2
Ruhedstolerance:				Morsø 3600	Varenr.: 71360700
Værktøjsnr.:	-			morsø	Tegningnr.: 3600-29
Tegningstype:	Emnetegning				

3600-29 Askeskuffe - Sheet1



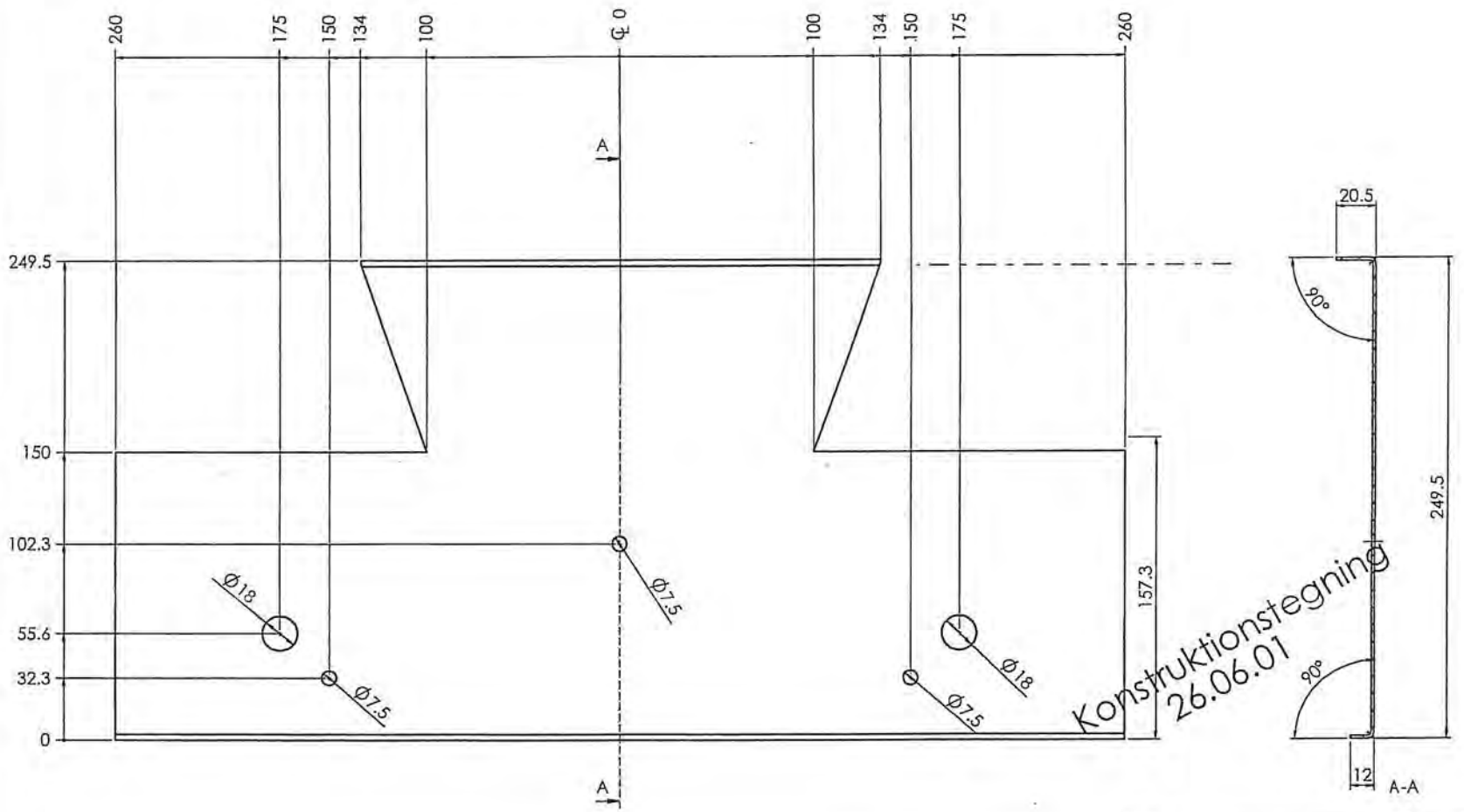
Rev.	Revisionstekst:					Sign.:	Dato:
Materiale:	1mm galvaniseret plade			Titel: Stråleplade bund	Konstr.:	KDU	26.06.01
Vægt:	1647.4 g	Bearbejdes:	Bukkes		Frigivet:		
Overfladebeh.:	Males		- m²		Tegn.format:	A3	
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m				Målforhold:	1:2	
Ruhedstolerance:				Morsø 3600	Varenr.:	71360800	
Værktøjsnr.:	-				Tegningsnr.:	3600-30	
Tegningstype:	Emnetegning						

3600-30 Stråleplade bund - Sheet1



Materiale:	1.5mm SPD plade			Titel: Luftspjæld		Konstr.:	KDU	14.06.01
Vægt:	191.7 g	Bearbejdes:	Buk			Frigivet:		
Overfladebeh.:	-		- m²			Tegn.format:	A3	
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m					Målforhold:	1:1	
Ruhedstolerance:				Morsø 3600		Varenr.:	71360900	
Værktøjsnr.:	-				morsø	Tegningsnr.:	3600-31	
Tegningstype:	Emnetegning							

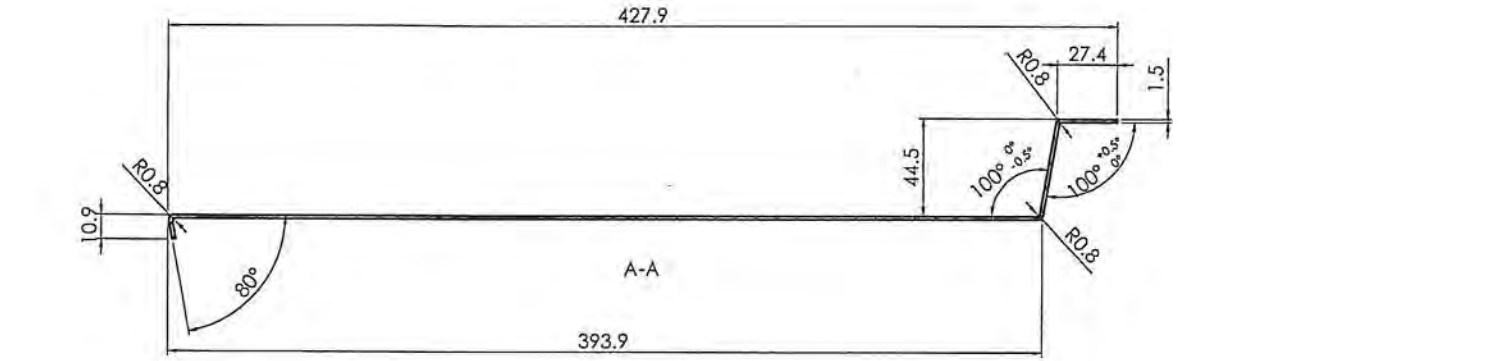
Rev.	Revisionstekst:	Sign.:	Dato:

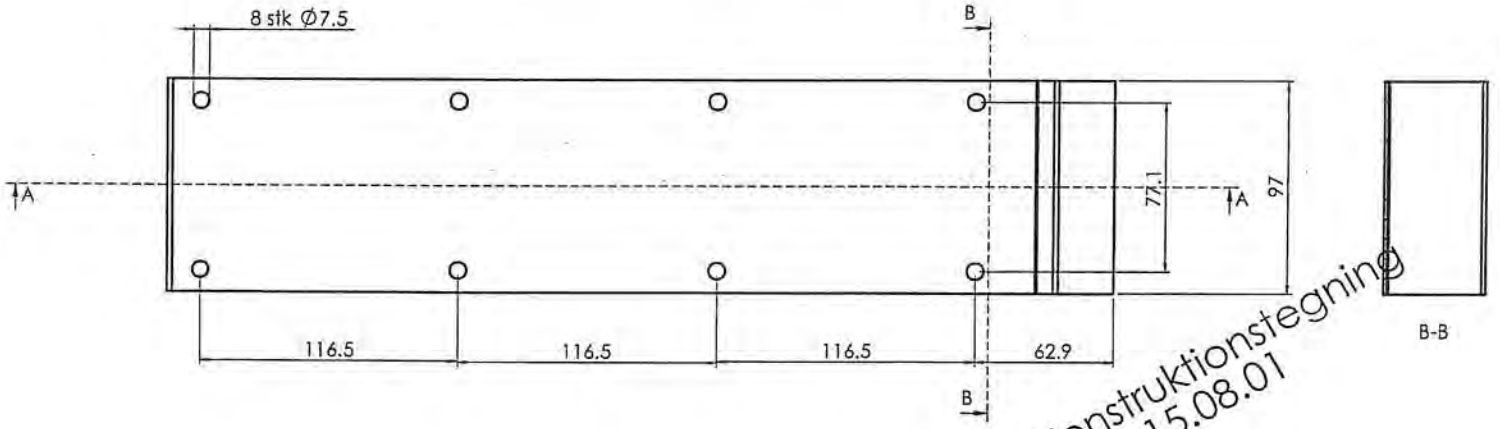


Materiale:	1.5 mm rustfri stål - AISI 304		
Vægt:	1302.7 g	Bearbejdes:	Bukkes
Overfladebeh.:	Ubehandlet		- m²
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m		
Ruhedstolerance:			
Værktøjsnr.:	-		
Tegningstype:	Emnetegning		

Rev.	Revisionstekst:	Sign.:	Dato:
Titel:	Røgvendeplade stål ved indv. topplade Morsø 3600	Konstr.:	KDu 26.06.01
		Frigivet:	
		Tegn.format:	A3
		Målforhold:	1:2
		Varenr.:	71361061
	morsø	Tegningsnr.:	3600-32

3600-32 Røgvendeplade stål - Shoot1





Konstruktionstegning
15.08.01

Rev.	Revisionstekst:	Sign.:	Dato:

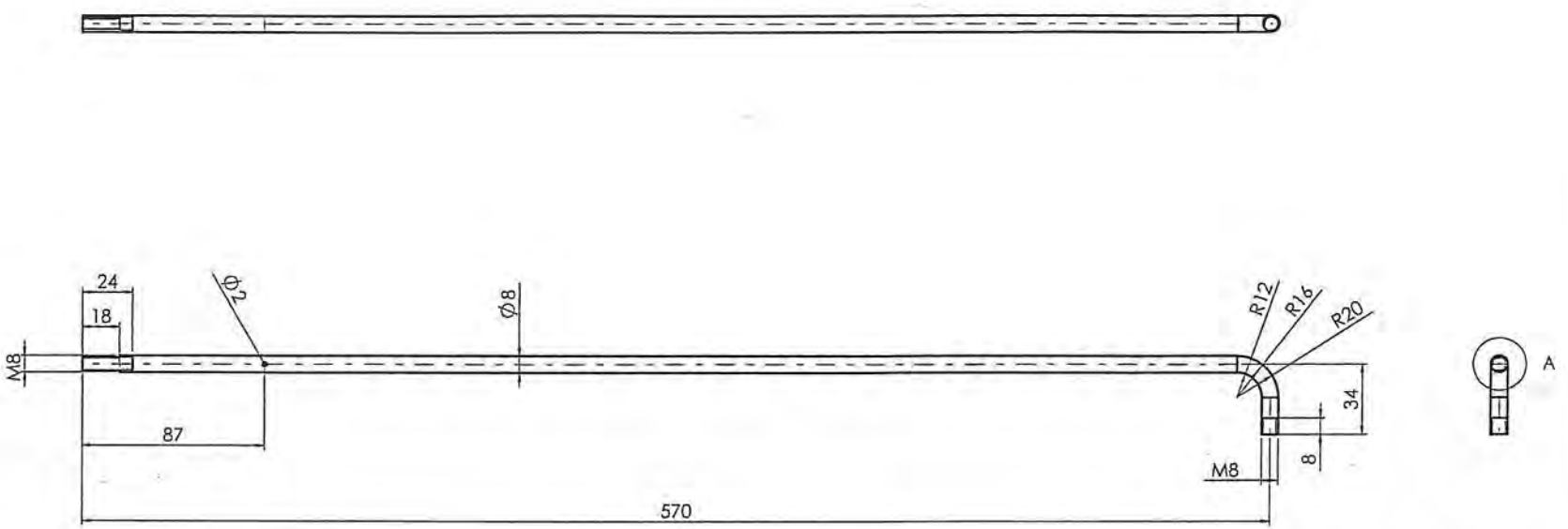
Materiale:	1.5mm rustfri stål - AISI 304		
Vægt:	536.3 g	Bearbejdes:	Buk/bore
Overfladebeh.:	Ubehandlet		- m²
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m		
Ruhedstolerance:			
Værktøjsnr.:	-		
Tegningstype:	Emnetegning		

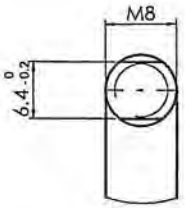
Titel:
Afdækningsplade luftkanal mellembund Morsø 3600

Konstr.:	KDU 04.07.01
Frigivet:	
Tegn.format:	A3
Målforhold:	1:2
Varenr.:	71361161
Tegningsnr.:	3600-33

morsø

3600-33 Afdækningsplade luftkanal - Sheet1





A (2 : 1)

Konstruktionstegning
04.07.01

Rev.	Revisionstekst:	Sign.:	Dato:

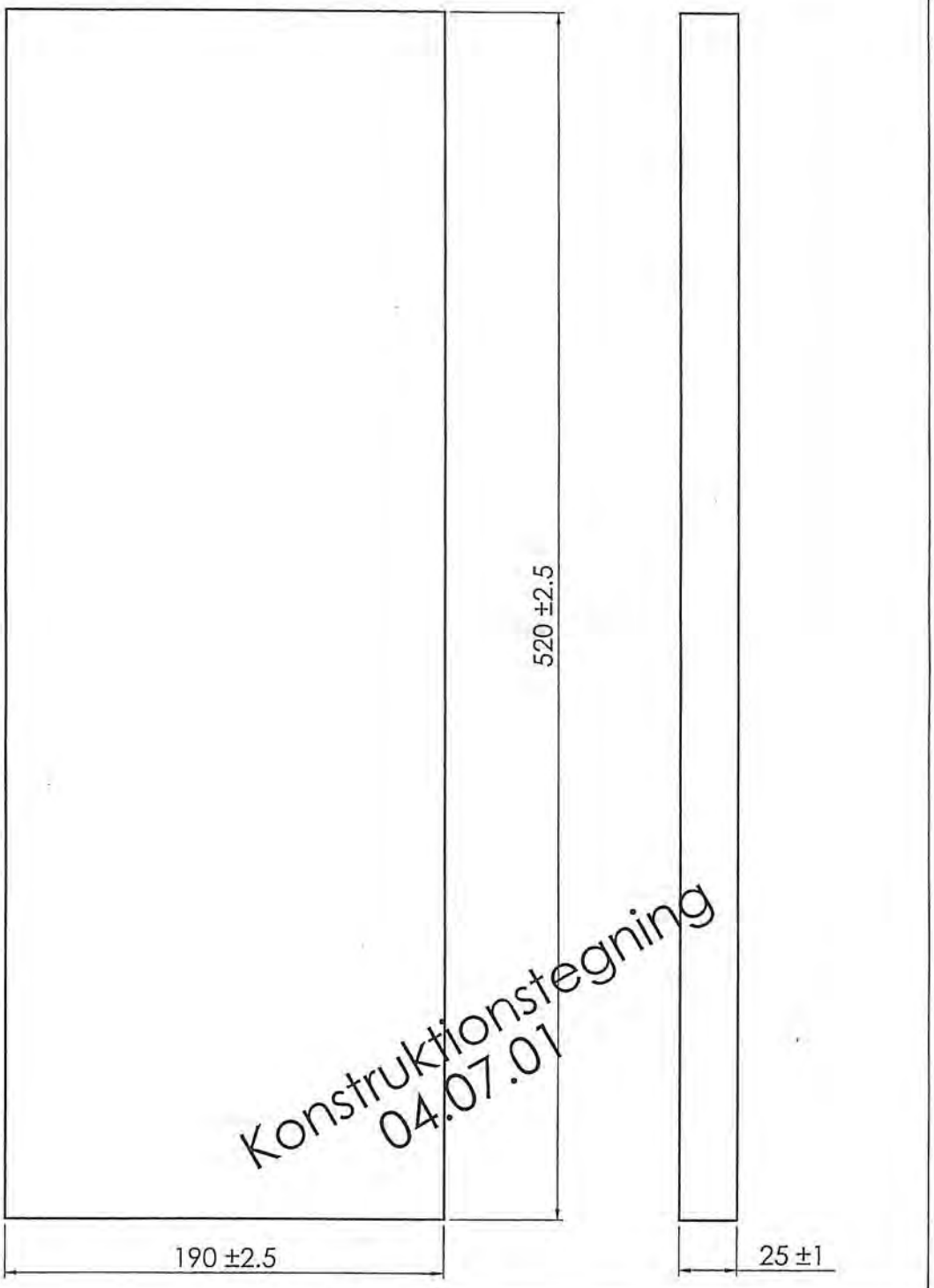
Materiale:	s8 automatstål		
Vægt:	235.0 kg.	Bearbejdes:	Buk/dreje
Overfladebeh.:	Males		0,0151 m³
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m		
Ruhedstolerance:			
Værktøjsnr.:	-		
Tegningstype:	Emnetegning		

Titel:
Reguleringsstang
Luftindtag
Morsø 3600

morsø

Konstr.:	KDU
Frigivet:	
Tegn.format:	A3
Målforhold:	1:2
Varenr.:	71361200
Tegningsnr.:	3600-34

3600-34 Reguleringsstang luftindtag - Sheet1



Konstruktionstegning
04.07.01

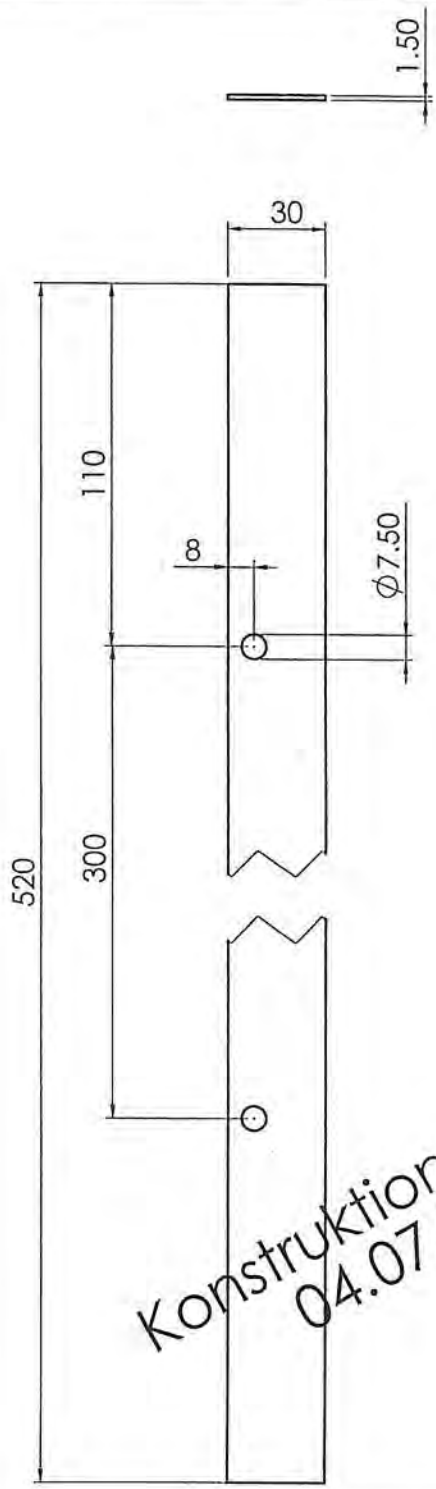
Rev.	Revisionstekst:	Sign.:	Dato:

Materiale:	25mm Vermiculit VIP 12			Titel:	
Vægt:	2964.0 g	Bearbejdes:	Nej	**Bagsten**	
Overfladebeh.:	Ubehandlet		- m²		
Måltolerance:	Se tegning				
Ruhedstolerance:				**Morsø 3600**	
Værktøjsnr.:	-				
Tegningstype:	Emnetegning				

Konstr.:	KDU 04.07.01
Frigivet:	
Tegn.format:	A4
Målforhold:	1:2.5
Varenr.:	79360300
Tegningsnr.:	3600-35

morsø

3600-35 Sten bag - Sheet1



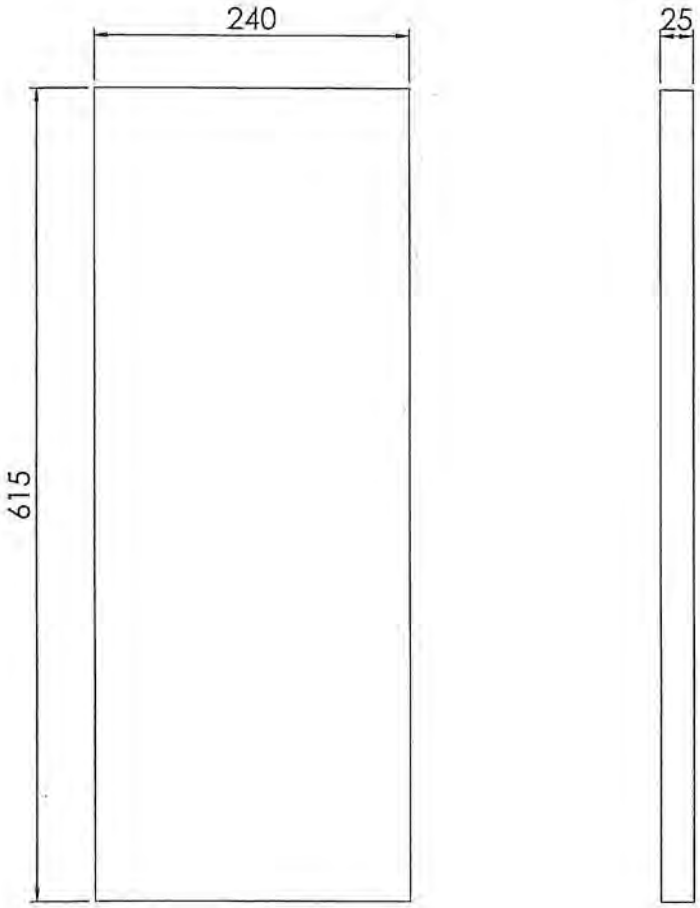
Konstruktionstegning
04.07.01

Rev.	Revisionstekst:	Sign.:	Dato:

Materiale:	1,5mm rustfri stål - AISI 304		
Vægt:	182.9 g	Bearbejdes:	bores
Overfladebeh.:	Ubehandlet		- m²
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m		
Ruhedstolerance:			
Værktøjsnr.:	-		
Tegningstype:	Emnetegning		

Titel:		Konstr.:	KDU 04.07.01
Holder for bagsten		Frigivet:	
		Tegn.format:	A4
		Målforhold:	1:2
Morsø 3600		Varenr.:	71361361
morsø		Tegningsnr.:	3600-36

3600-36 Holder for bagsten - Sheet1



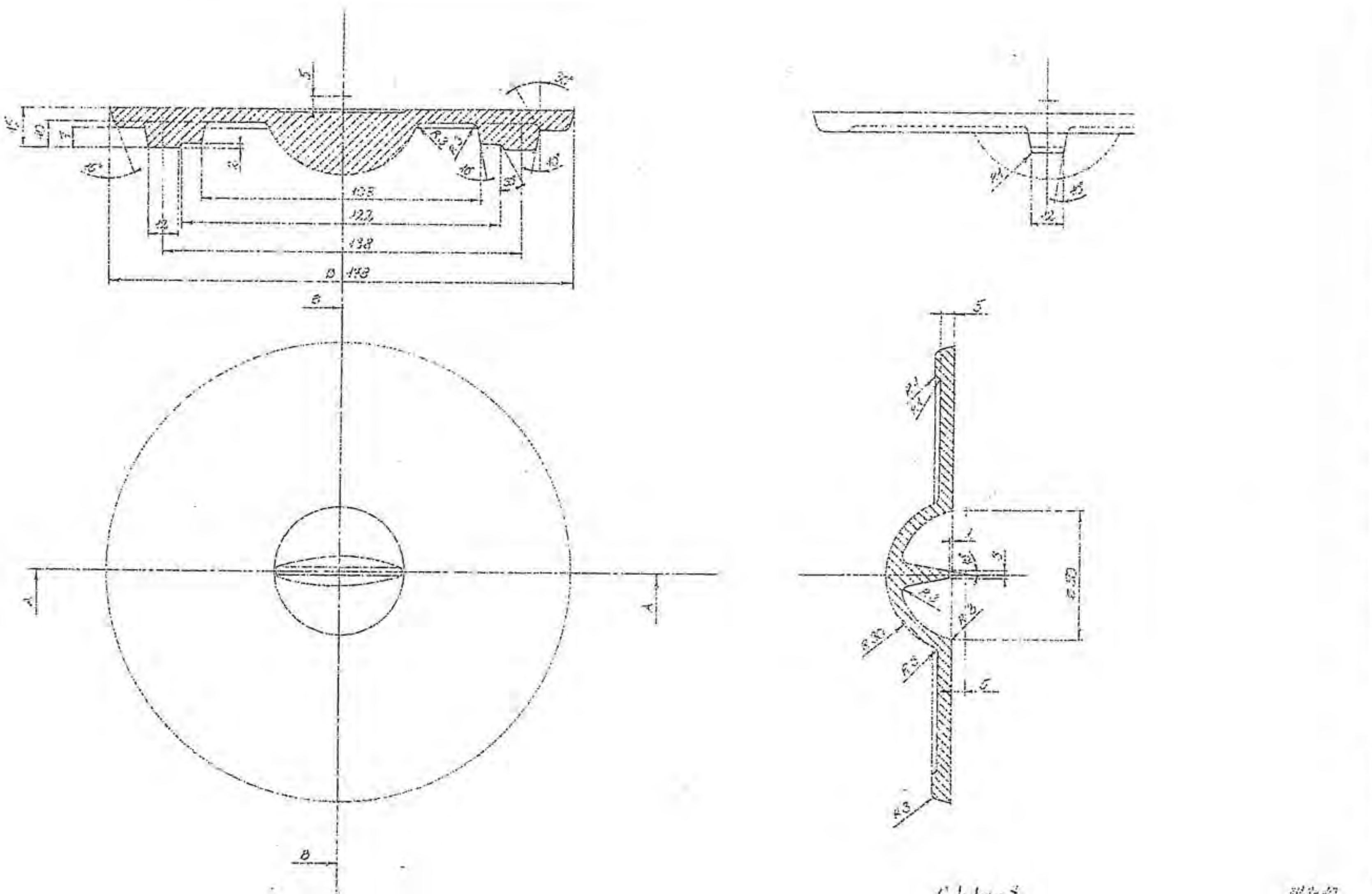
Konstruktionstegning
16.08.01

Materiale:	25 mm Isoleringsmåtte		
Vægt:	- kg.	Bearbejdes:	-
Overfladebeh.:	-		- m²
Måltolerance:	Mål uden toleranceangivelse		
Ruhedstolerance:			
Værktøjsnr.:	-		
Tegningstype:	Emnetegning		

Rev.	Revisionstekst:	Sign.:	Dato:

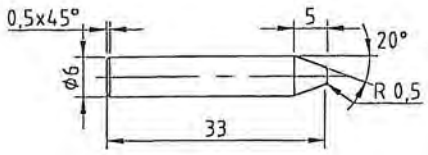
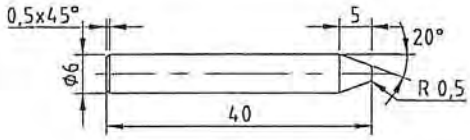
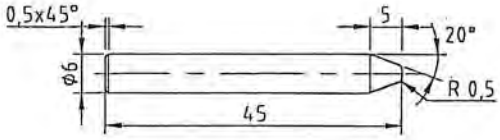
Titel:		Konstr.:	KDU 11.07.01
Isoleringsmåtte 3600 USA		Frigivet:	
		Tegn.format:	A4
		Målforhold:	1:5
Morsø 3600		Varenr.:	79074800
morsø		Tegningsnr.:	3600-37

3600-37 Isoleringsmåtte - Sheet1



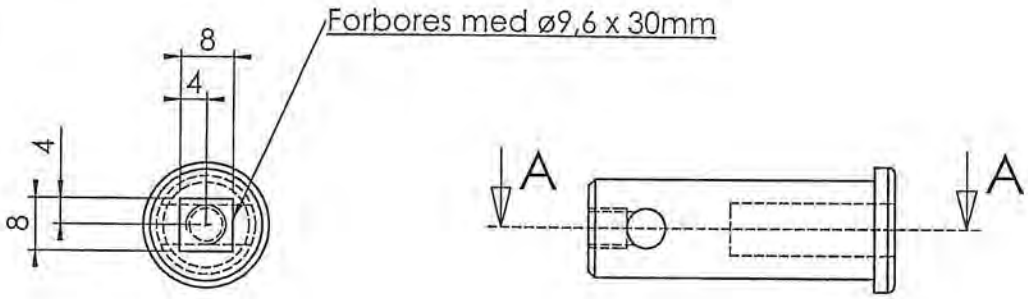
Solidpart

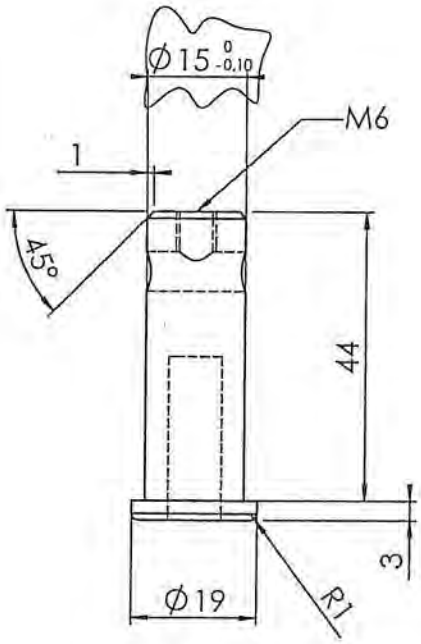
LEVERANDØR TIL DET KGL. DANSKE HOF **morsø** JERNSTØBERI	DÆKSEL MORSØ 1135	DATO 13 MAJ 1987	SIGN. K.
		MÅL 1:1	ÆNDRET
			MODELNR. 2510
		TEGNINGSNR. 1136-16-2	

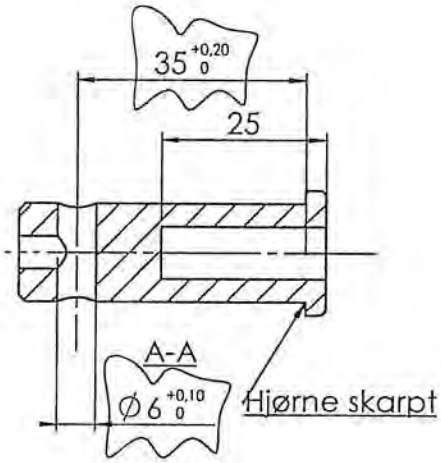
	Anvendes til:
EDB nr. 541403  	1410
EDB nr. 542056  	1B 2B 1126
EDB nr. 541082  	1610 1710

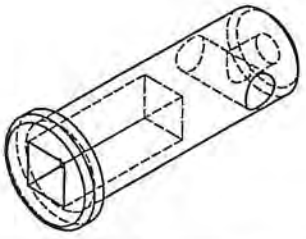
Mart.: Ø6 Rf. automatstål
EDB nr. 714005

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









Materiale: Rustfast stål

Rev.	Revisionstekst:	Sign.:	Dato:
g	Tolerancer tilføjet	KDU	11.10.99
f	Notater tilføjet	KDU	07.09.99
e	Fjerne M4 - fiksering	KDU	07.09.99
d	Tilføje M4m - fiksering	KAA	16.09.97
c	Tilføje målsætning	KDU	20.12.96
b	Gamdrup Tegneteknik	HCH	April 96

Titel: Døraksel 1126

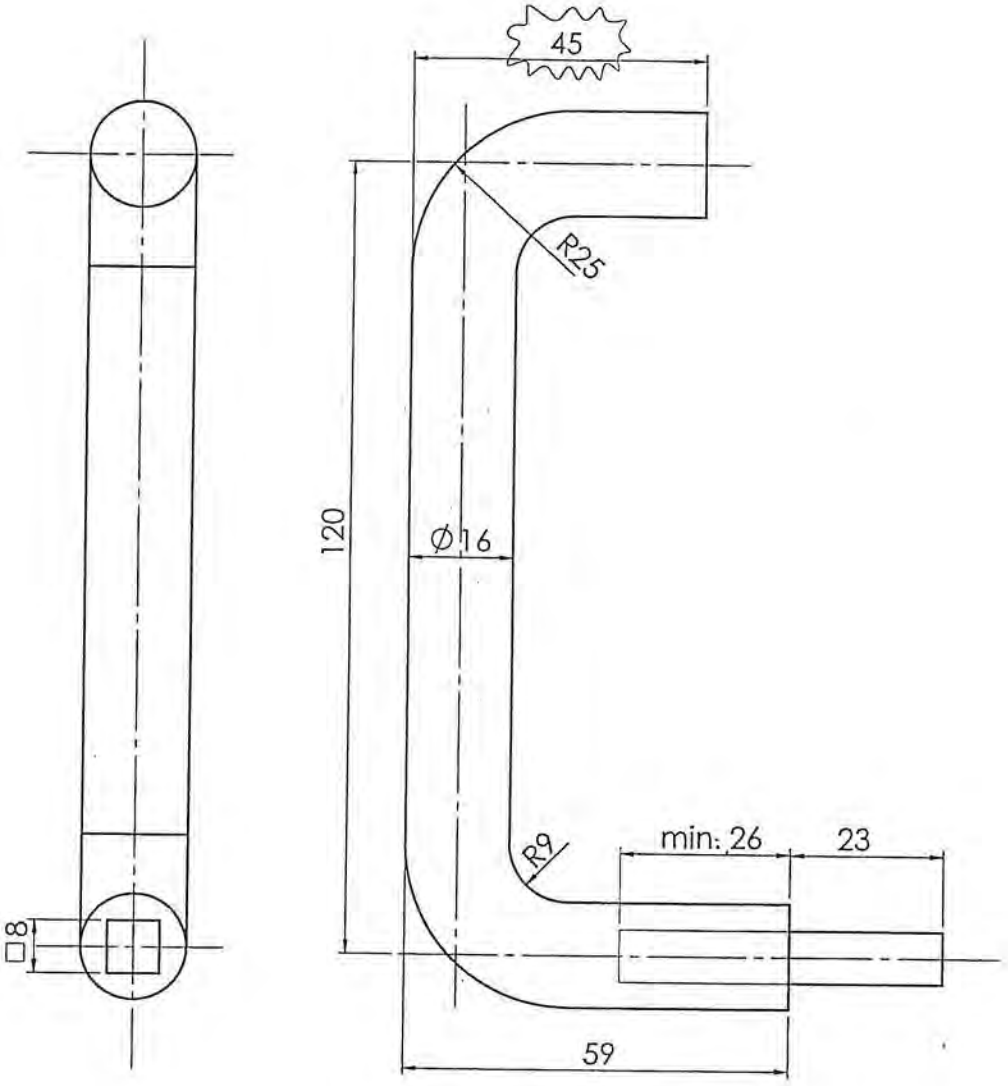
Filnavn: 1126/1126-44.drw

morsø Jernstøberi A/S

Sign.:	Dato:
N.Aa	03.12.87
Tegn.format: A4	Målforhold: 1:1

Varenummer: 752627

Tegningsnummer: 1126-44 g



d	Ændret mål	RSV	22.05.2001
c	Ændring af tegningsnr.	KDU	19.12.1996
b	Gamdrup Tegne Teknik	HCH	April 1996
Rev.	Revisionstekst:	Sign.:	Dato:

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

Titel:

1126 dørhåndtag

Morsø 1126

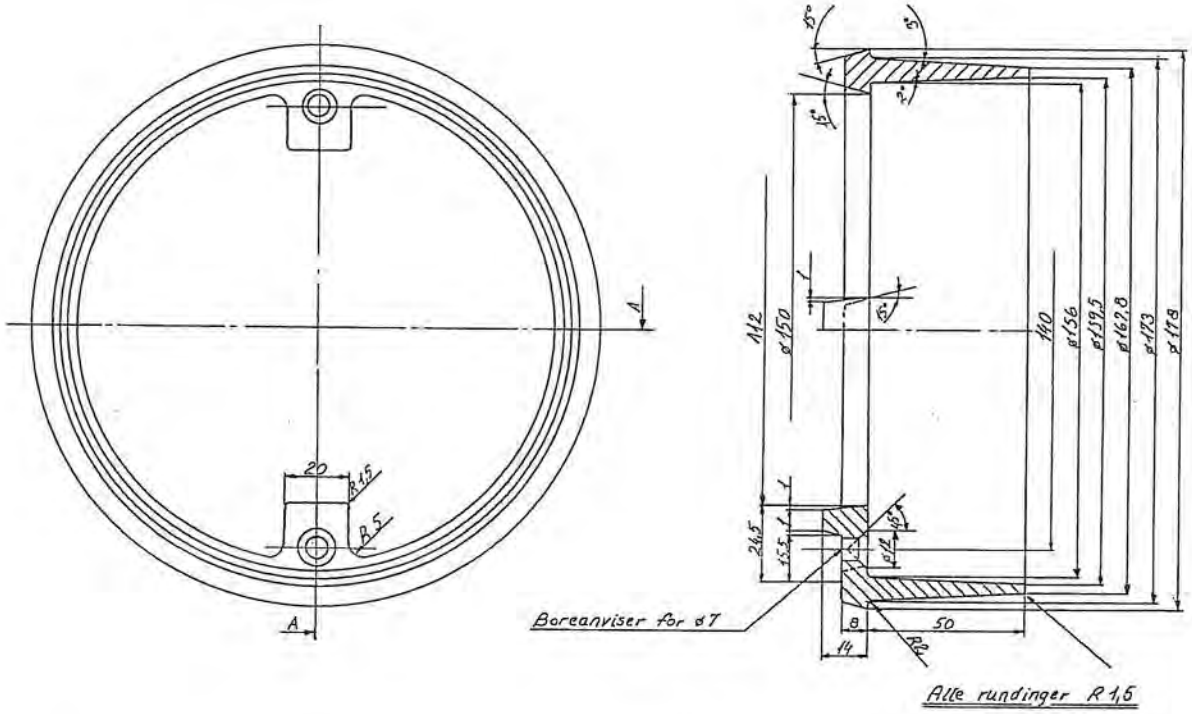
Konstr.:	N.Aa 14.10.87
Frigivet:	
Tegn.format:	A4
Målforhold:	1:1
Varenr.:	752625

morsø

Tegningsnr.: **1126-45 d**

1126-45 Dørhåndtag - Sheet1

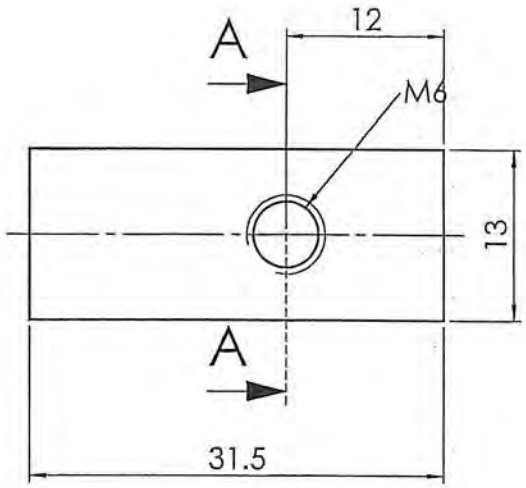
Snit A-A

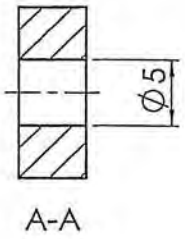


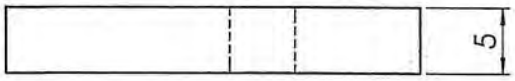
Solid cast

3126.27

morsø	Røgtud ø155DK	DATO 19/10 89	SIGN. HP97
		MÅL 1:1	ÆNDRET
			MODELNR. 2627
	1:50		TEGNINGSNR. 1126-64-2







Rev.	Revisionstekst:	Sign.:	Dato:

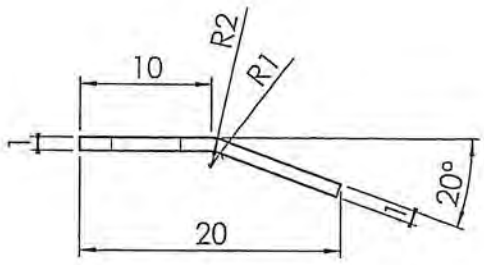
Materiale:	Sort fladjern			Konstr.:	RSV 03.03.2000
Vægt:	0,015 kg.	Bearbejdes:		Frigivet:	
Overfladebeh.:			m²	Tegn.format:	A4
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m			Målforhold:	2:1
Ruhedstolerance:				Varenr.:	44256700
Værktøjsnr.:				Tegningsnr.:	1400-204
Tegningstype:	Emnetegning				

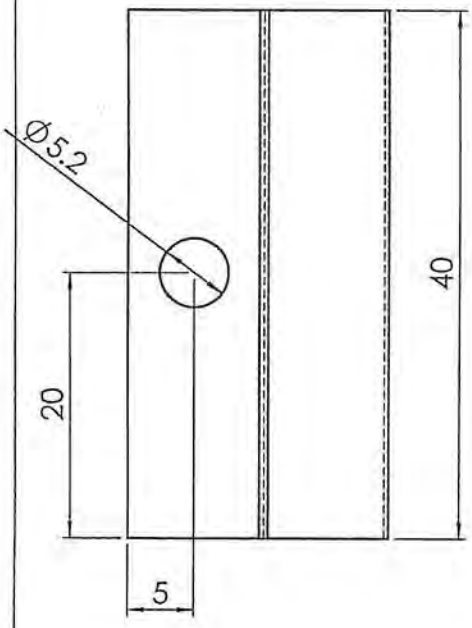
Titel: **Lus med gevind**

Morsø 1400

morsø

1400-204 - Sheet1





Rev.	Revisionstekst:	Sign.:	Dato:
c	Ændret varenummer	RSV	14.03.2001
b	Ændret mål	RSV	06.09.2000

Materiale:	1 mm rustfri plade		
Vægt:	0,006 kg.	Bearbejdes:	
Overfladebeh.:			m²
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m		
Ruhedstolerance:			
Værktøjsnr.:			
Tegningstype:	Emnetegning		

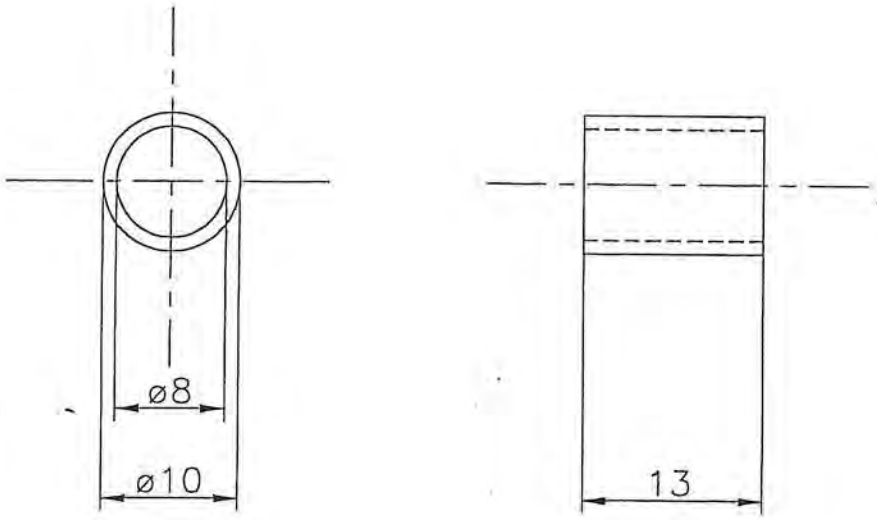
Titel: **Glasbeslag 2**

Morsø 1400

Konstr.:	RSV	07.03.2000
Frigivet:	RSV	30.06.2000
Tegn.format:	A4	
Målforhold:	2:1	
Varenr.:	54146361	
Tegningsnr.:	1400-206 c	

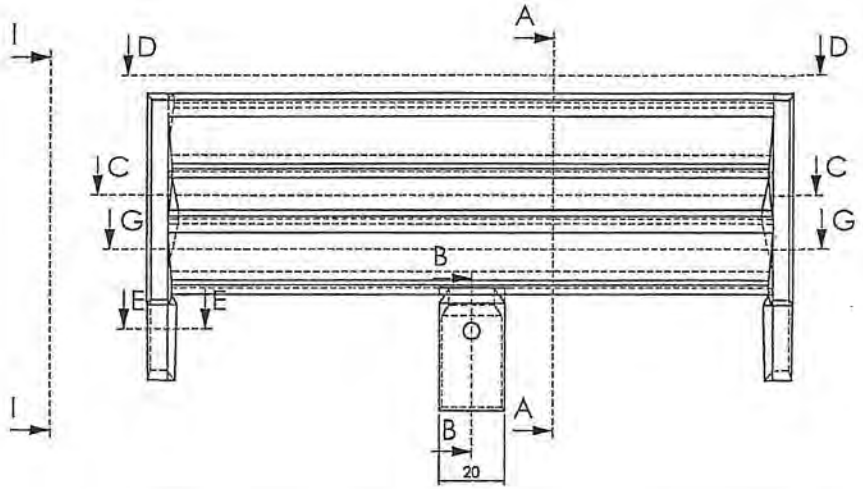
morsø

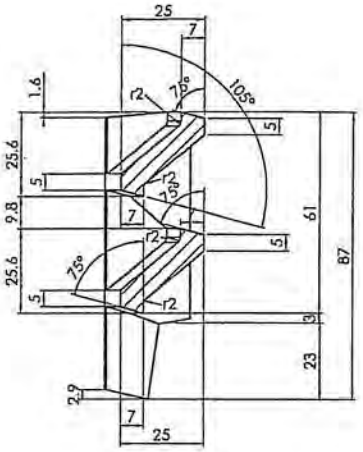
1400-206 - Sheet1

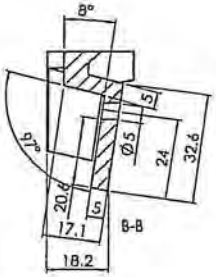


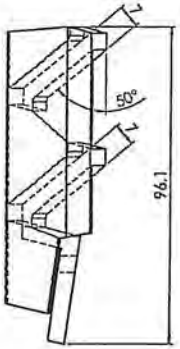
Matr:10x1 Hydraulikrør galv. varenr.712602

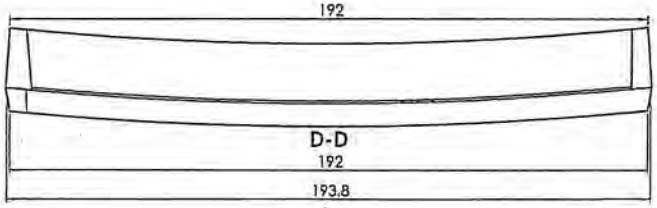
Titel: Afstandsrør ø10x1 L=13	Sign.: RS	Dato: 970113	Revision	Sign.	Dato
	Tegn.form.: A4	Målforhold 2:1			
Tegningsnummer: 1400-303-4	Varenummer: 541438				
MORSØ Jernstøberi A/S	Filnavn: 1400-303				

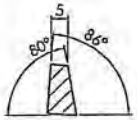


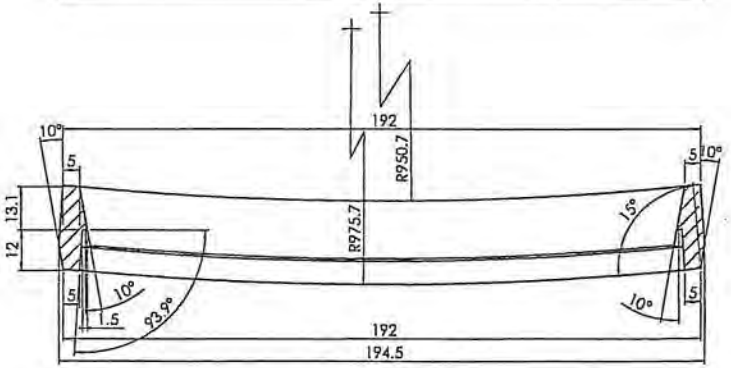


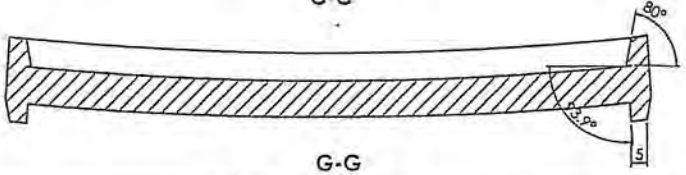






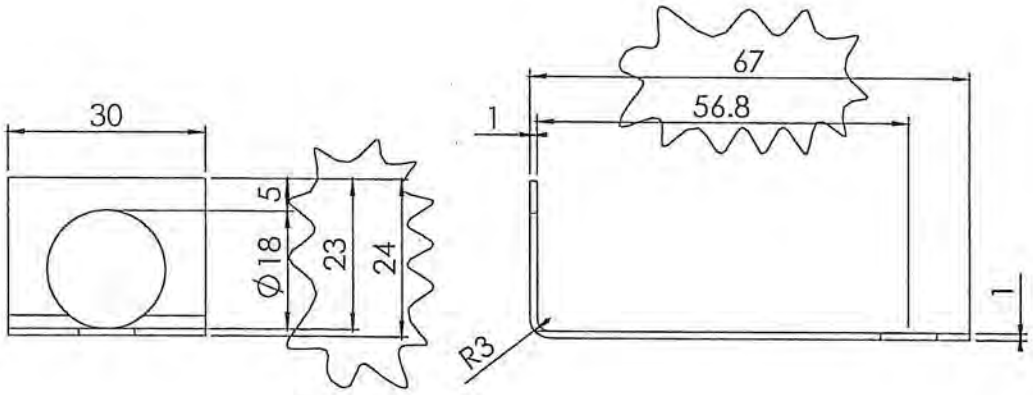


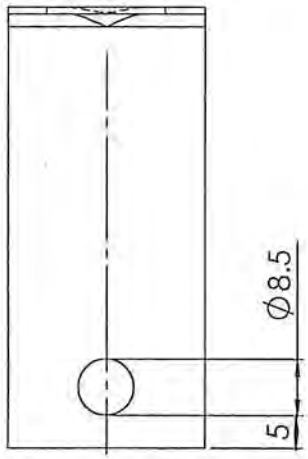


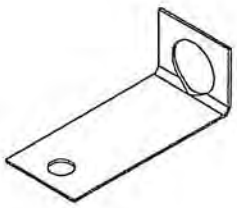


Note:
Generel radius = 1.

Materiale:	GG 15 Cr			Rev.	Revisionstekst:	Sign.:	Dato:
Vægt:	795 g	Bearbejdet:	Rå	Titel:	Farrist 2110 USA	Tegnet:	EDU 29.09.2000
Overfladebeh.:	-		- m²			Frigivet:	RSV 11.06.2001
Måletolerance:	Mål uden tolerancepåskrivelse iht. DS-norm nr. 8062 CTR					Tegn.format:	A2
Ruhedstolerance:					Morsø 2110 USA	Målestok:	1:1
Varmebehandl.:	Modelnr. 1849					Varenr.:	34184900
Tegningstype:	Støbetegning			morsø		Tegningsnr.:	2100-147 a







Note: Skarpe kanter brydes.

Rev.	Revisionstekst:	Sign.:	Dato:
b	Påført at skarpe kanter brydes	RSV	06.10.2000

Materiale:	1 mm SPD plade		
Vægt:	0,019 kg.	Bearbejdes:	Buk/bore
Overfladebeh.:	-		- m²
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m		
Ruhedstolerance:			
Værktøjsnr.:	-		
Tegningstype:	Emnelegning		

Titel:

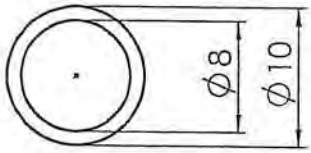
Ophæng til greb

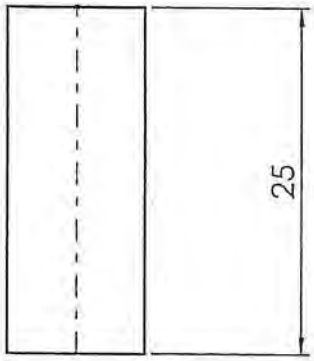
Morsø 2100

morsø

Konstr.:	RSV	07.07.2000
Frigivet:	RSV	15.03.2001
Tegn.format:	A4	
Målforhold:	1:1	
Varenr.:	54185800	
Tegningsnr.:	2100-163 a	

2100-163 ophæng til greb - Sheet1

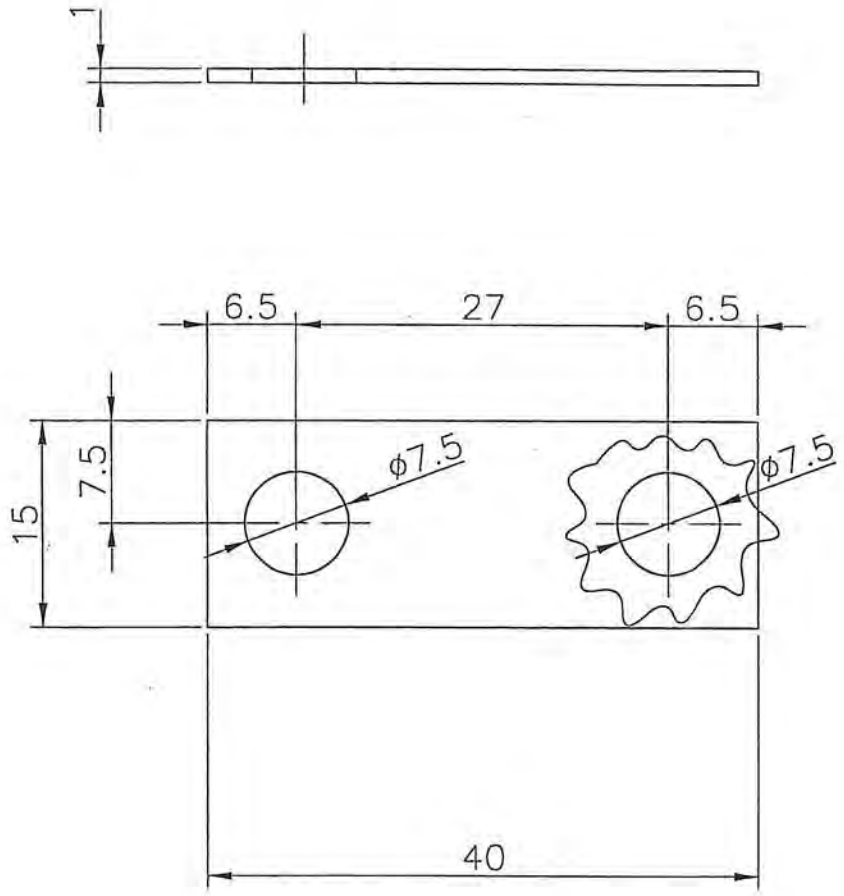




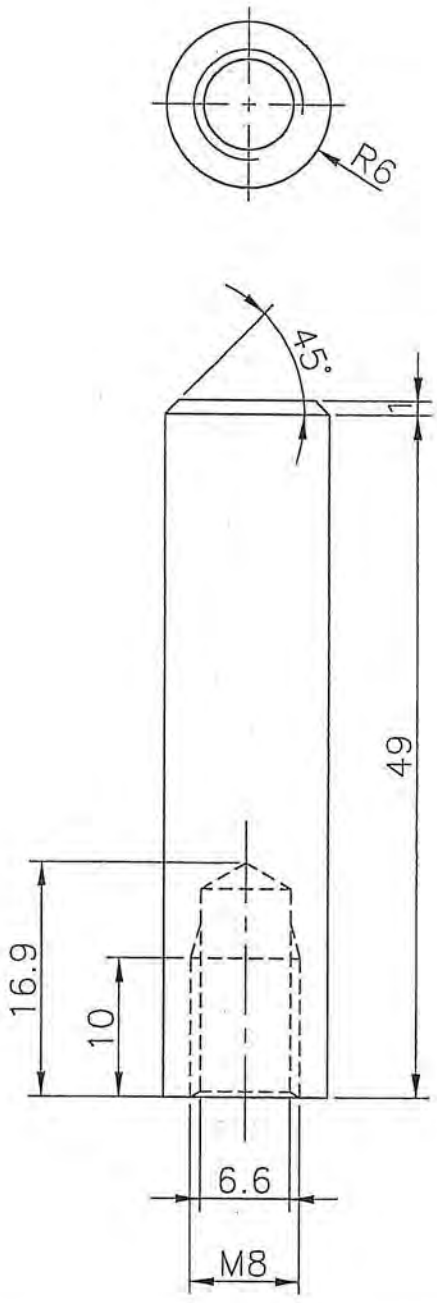
b	Varenr. ændret fra 71313100	KDU	05.09.2000
Rev.	Revisionstekst:	Sign.:	Dato:

Materiale:	ø10x1 rør			Titel:	Konstr.:	KDU	09.06.2000
Vægt:	0,01 kg.	Bearbejdes:		Afstandsrør ø10x1	Frigivet:	KDU	09.06.2000
Overfladebeh.:			m²	L = 25mm	Tegn.format:	A4	
Måltolerance:	Mål uden toleranceangivelse DS/ISO 2768-1 m				Målforhold:	2:1	
Ruhedstolerance:				Morsø 3100	Varenr.:	54313100	
Værktøjsnr.:				morsø	Tegningsnr.:	3100-36 b	
Tegningstype:	Emnetegning						

3100-36 - Sheet1



				Matr.: 15x1 mm Båndstål uhærdet	Vægt: 0,01 Kg.	
Rev.	Revision	Sign.	Dato	Titel:	Sign.: KDU	Dato: 28.07.98
b	Hul påført	AØS	10.11.98	Mont.stål f. reg.stang Morsø 3400	Tegn.form.: A4	Målforhold 2:1
				Filnavn: 3400-18	Varenummer: 71346500	
				morsø Jernstøberi A/S	Tegningsnummer: 3400-18 b	



Matr.: Rustfri stål

Rev.	Revision	Sign.	Dato
b	Påført matr.	RSV	10.10.00

Titel: MORSØ 3400
Greb til
Reguleringsstang

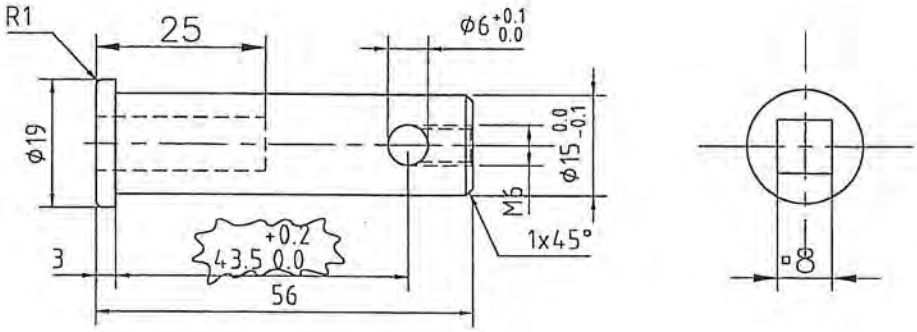
Sign.:	Dato:
AØS	30.10.98
Tegn.form.:	Målforhold
A4	2:1

Filnavn: 3400-41

Varenummer: 75180400

morsø
Jernstøberi A/S

Tegningsnummer: 3400-41 b



Matr. Rustfast stål

Rev.	Revision	Sign.	Dato
b	Ændret	RSV	13.06.97
c	Varenr. tilføjet	KDU	20.11.97
d	Ændret mål	RSV	22.12.98
e	Mål ændret fra 43	KDU	17.06.99
f	Mål ændret fra 43,3	RSV	11.11.99

Titel:
Døraksel for 4600
Rund dør

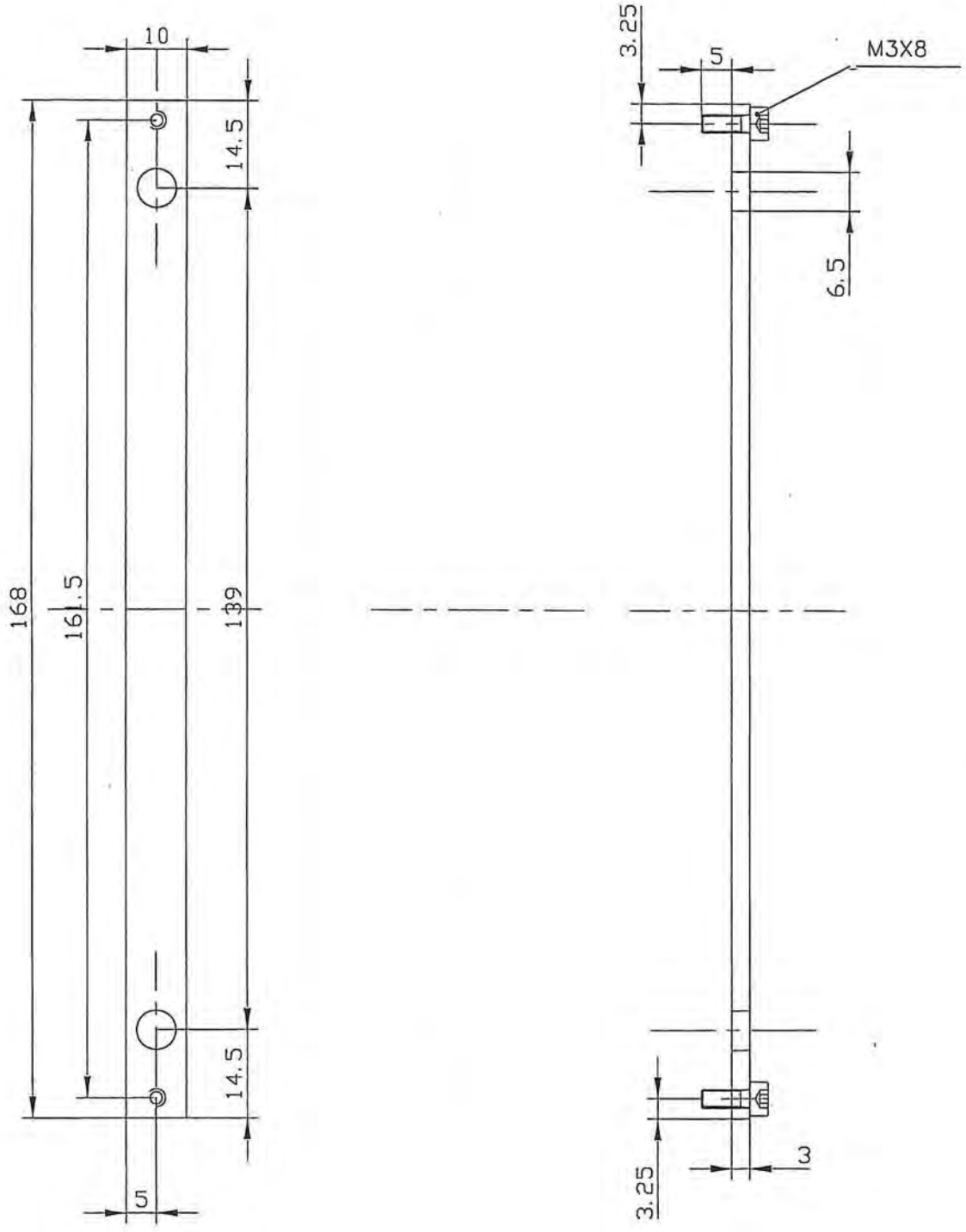
Filnavn:
4600-12

morsø
Jernstøberi A/S

Sign.:	Dato:
RS	22.05.97
Tegn.form.:	Målforhold
A4	1:1

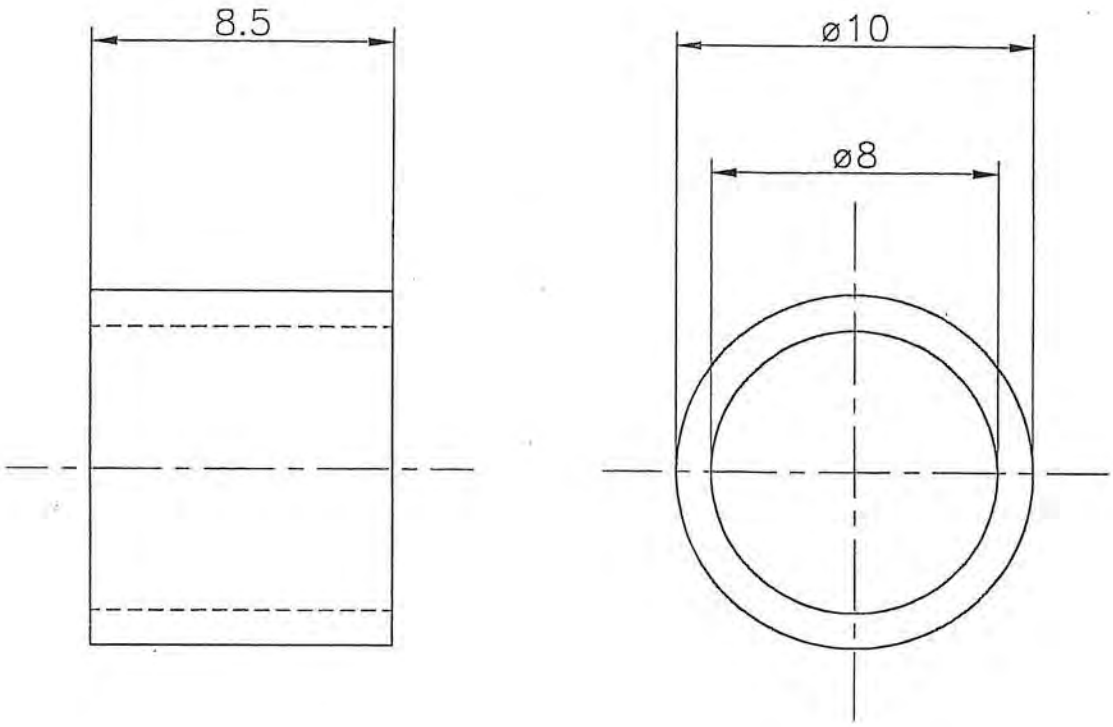
Varenummer:
75462700

Tegningsnummer:
4600-12 f



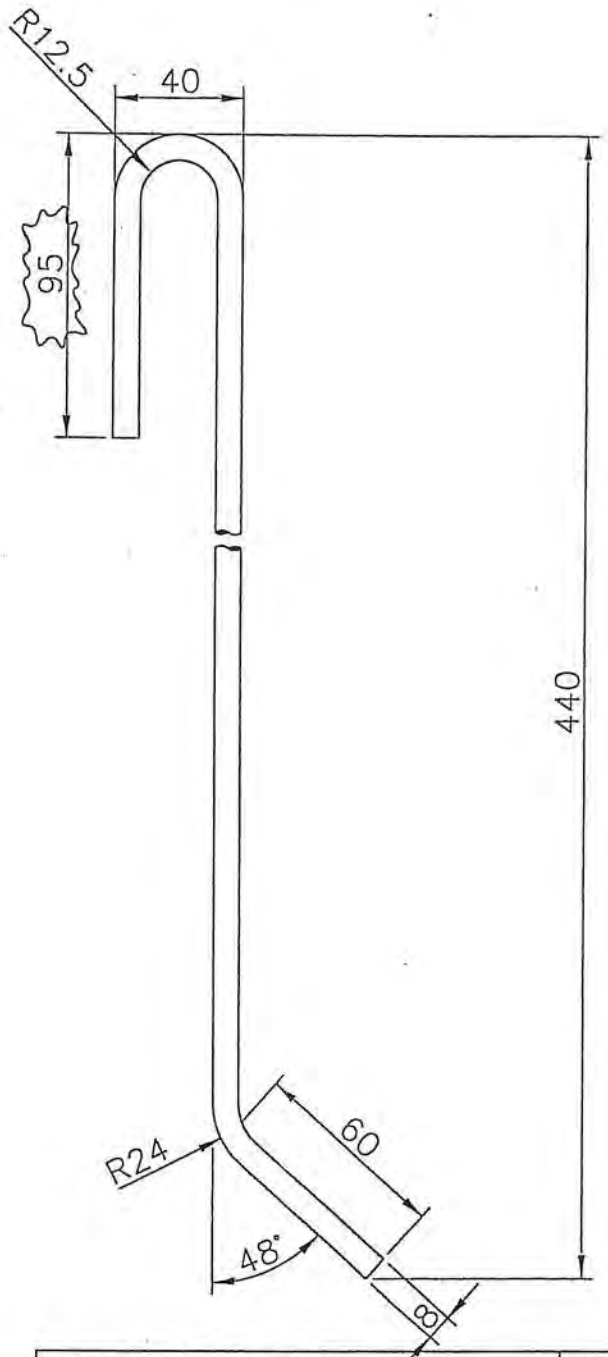
10x3 L=168mm

Matr.: Sort båndstål		Vægt: xxxx Kg.
Titel: MODULOVN BØJLE TIL RØGDÆKSEL	Sign.: CHK / Dato: 21.11.94	Revision / Sign. / Dato
	Tegn.form.: A4 / Målforhold 1:1	KAA 26.09.95
Tegningsnummer: 5000-63-4	Varenummer: 545006	Varenr.+mål ændret RSV 14.02.97
morsø Jernstøberi A/S	Filnavn: 5000-63	d Ændret mål RSV 05.03.99



Ø10x1 Hydraulikrør galv.

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



				Matr.: ø8 mm automatstål	Vægt: 0,2 Kg.
Rev.	Revision	Sign.	Dato	Titel:	Sign.: KAA / Dato: 30.07.98
b	Ombuk forlængel 70 mm	KDU	11.06.99	Ildrager	Tegn.form.: A4 / Målforhold: 1:2
				New Generation/Classic	
				Filnavn: 9000-05	Varenummer: 79900321
				morsø Jernstøberi A/S	Tegningsnummer: 9000-05 b

APPENDIX G

Ferguson, Andors & Company

P.O.Box 678, South Royalton, VT 05068 • 802-763-2339 (Voice and Facsimile)

August 1, 2001

Mr. Bill Keen
Intertek Testing Services
8431 Murphy Drive
Middleton, WI 53562

Dear Bill:

As you know, we will be representing Morsø Jernstøberi A/S during the upcoming EPA certification testing of their new Model 3600 non-catalytic woodstove. This product does not have a fan either as standard or optional equipment.

We would like to provide the following information regarding operating procedures and air settings that will be helpful in obtaining the required burn rate ranges.

First, for the lower burn rate tests (category 1 and 2), two pre-burn fuel loads should be burned in the stove prior to the actual test load. The stove should be shoveled out and the ash pan emptied after the first pre-burn load. This will help insure that the stove reaches a good equilibrium temperature and that the test runs will not exceed the allowable stove body "Delta T" requirements.

For the lowest air setting, the door should be left slightly open for the first 90 seconds and the air control should remain fully open for the full five-minute start-up period and then fully closed.

If this results in a burn rate above one kilogram per hour, repeat the procedure but close the air control in small increments starting at three and one-half minutes.

If the initial burn rate is below one kilogram per hour, repeat the test conditions to obtain a second run in category 2.

For the maximum burn rate test, it is not necessary to leave the door cracked open after loading the test fuel. Just be sure to add enough pre-burn fuel to obtain a good charcoal bed and make the one-hour required pre-burn time period.

For category 3, we recommend setting the air control lever to a position where the uppermost corner of the end of the control lever is 1.75" from the lowest plane of the ashlip. The door should be cracked open for 90 seconds and the air control set at maximum for the first five minutes.

These settings should be used as a guideline. Adjustments to meet the required burn rate categories should be made if needed based on your best judgements.

Sincerely,

Bob Ferguson

Robert W. Ferguson

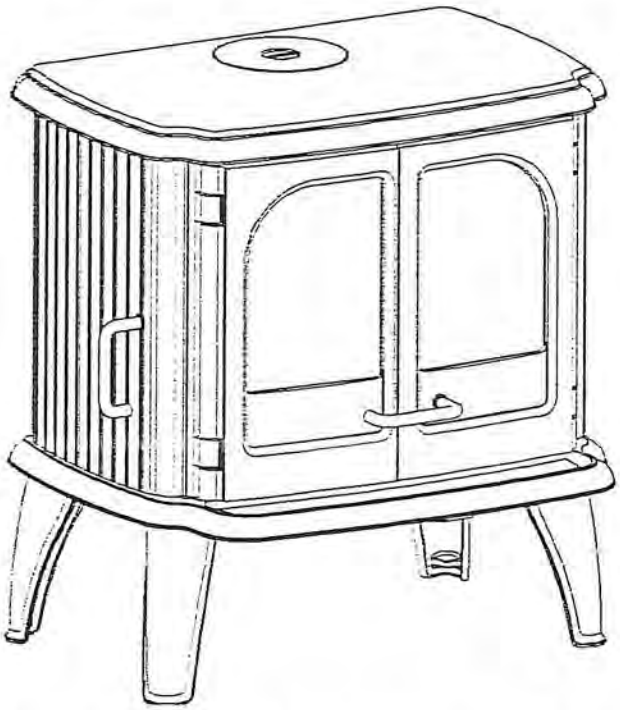
morsø

By appointment to the Royal Danish Court

Installation and Operating Instructions

3600

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 3600 meets the U.S. Environmental Protection Agency's emission limits for wood heaters sold on or after July 1, 1990

Warnock Hersey ®

The Morsø 3600 have been tested by Intertek Testing Services and is listed by Warnock Hersey, Inc. The test standards are ANSI/UL-1482 for the United States and ULC S627 for Canada.

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

CONTENTS:

1.0 Installation of your Morsø stove

Installation of woodburning stoves must be safe and legal.

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

Before you start installing your stove, make sure that:

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

All neccessary approvals are needed from the local building officials.

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

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

Do not connect to any air distribution duct or system.

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

1.1 Checking loose parts in the stove

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

Standard Accessories

Poker, ceramic flue connection gasket and ash can tools are standard accessories, and can 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).

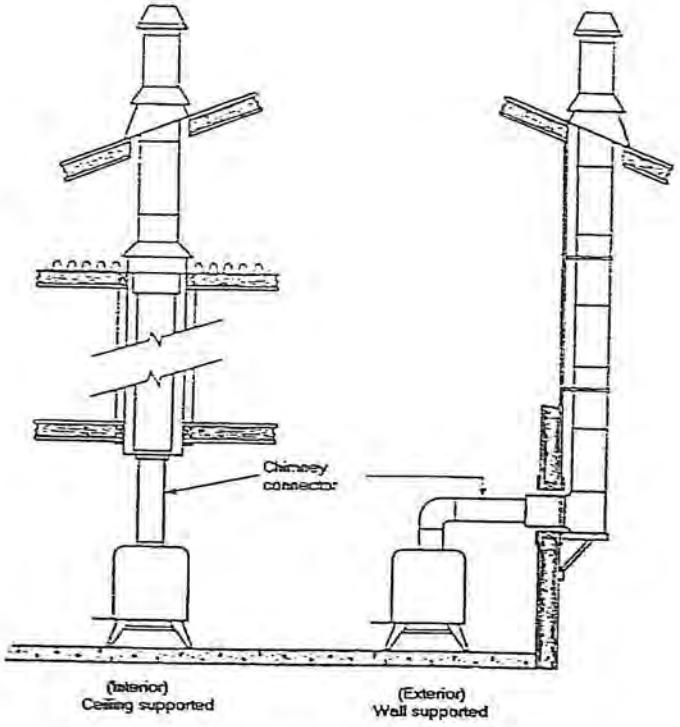
Use a residential type masonry or listed type HT factory-built chimney.

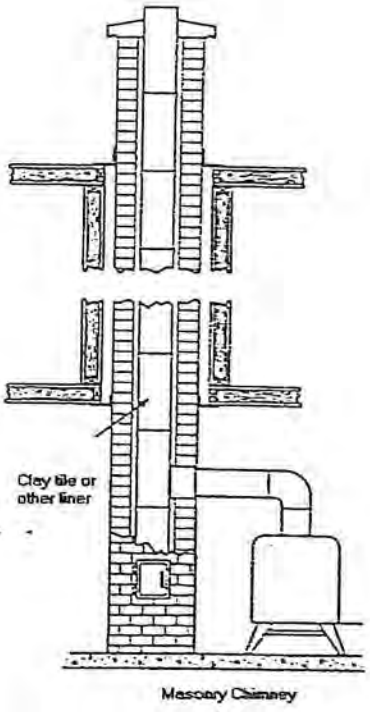
High Temperature (H.T.) Chimney Standard UL-103-1985 (2100° F.) for the USA, and High Temperature (650°C) Standard ULC S-629 for Canada.

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

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

Typical Factory-Built or Masonry Chimney Installations





1.3 Flue Connection

The stove is supplied from the factory with a flue collar fitted to the top plate and a round blanking plate blocking off the rear flue exit (behind the rear shield plate).

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

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

1.4 Connection to the existing chimney

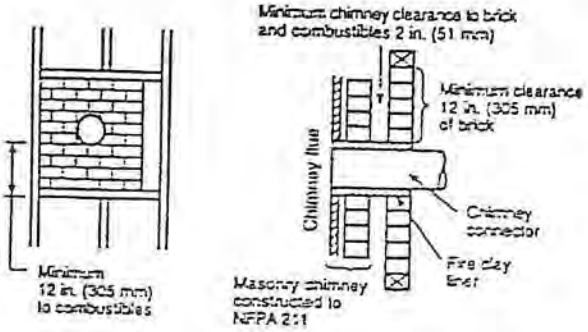
A chimney connector is the double-wall or single-wall pipe that connects the stove to the chimney. The chimney itself is the masonry or prefabricated structure that encloses the flue. Chimney connectors are used only to connect the stove to the chimney.

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

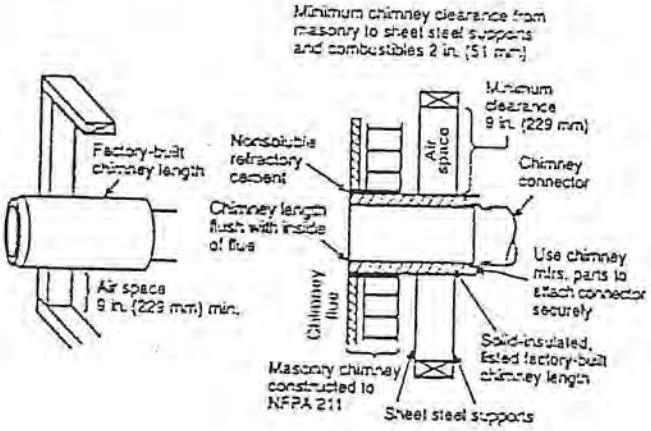
If possible, do not pass the chimney connector through a combustible wall or ceiling. If passage through a combustible wall is unavoidable, refer to the sections on Wall Pass- Throughs. Do not pass the connector through an attic, a closet or similar concealed space when installing the chimney connectors.

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

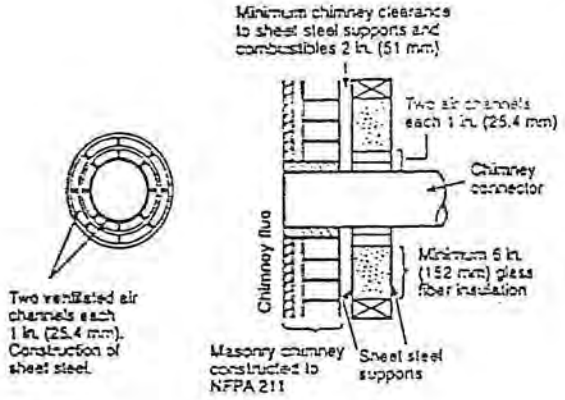
Be sure the installed stove and chimney connector are correct distances from near by combustible materials. See the clearance paragraph page 8.



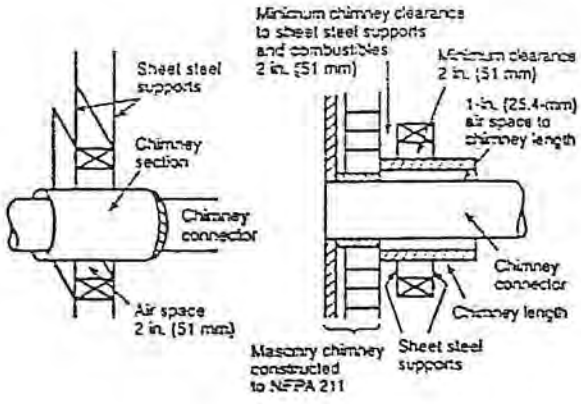
A Minimum 3.5-in thick brick masonry all framed into combustible wall with a minimum of 12-in brick separation from clay liner to combustibles. The fireclay liner shall run from outer surface of brick wall to, but not beyond, the inner surface of chimney flue liner and shall be firmly cemented in place.



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



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



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

1.5 Positioning the stove

Distance to walls and lintel

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

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

Appliance Clearances

Chimney connector clearances	Unprotected Surfaces			Protected Surfaces (NFPA-211)		
	Parallel		Corner	Parallel		Corner
	Side	Rear		Side	Rear	
Single wall connector	-in -mm	-in -mm	-in -mm	-in -mm	-in -mm	-in -mm
Double wall connector	-in -mm	-in -mm	-in -mm	-in -mm	-in -mm	-in -mm

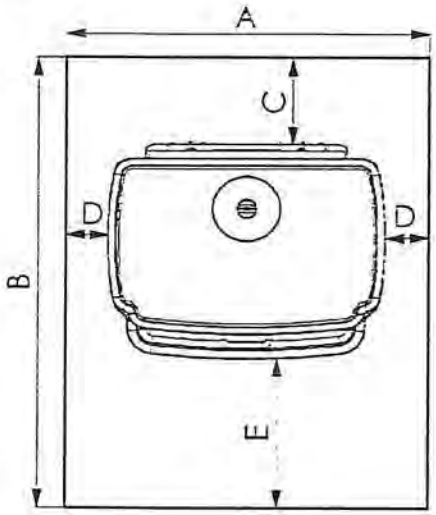
Fireplace Hearth Installation					
	In	Mm		In	Mm
Unit to top trim			Unit to side trim		
Unit to mantle			Unit to sidewall		

On the floor

If the stove is to be placed on a combustible floor, a, solid, non-combustible layer should cover the floor beneath the stove. This layer should cover an area of at least 16 inches in front of the stove doors and at least 8 inches either side of the opening and 6" to the rear.
You must ensure that the floor in this area can hold the weight of the stove comfortably.

The floor protection in front of the unit must have an insulative R-value of 1.0 (English units).

In Canada non-combustible floor protector is required under the stove as well. The floor protector must extend 18 inches (460mm) to the front and 6 inches (155mm) from the sides and rear.



	U.S.	Canada
A.	"	" (mm)
B.	"	" (mm)
C.	"	" (mm)
D.	"	" (mm)
E.	"	" (mm)

Distance to furniture

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

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

Note:

Acid Protection

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

Fresh Air Inlet

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

2.0 Operation

2.1 Before you start firing

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

Caution:

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

Do not use chemicals or fluids to start the fire.

Do not burn garbage or flammable fluids.

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

Choosing your fuel

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

Cut the wood to a length of max 22 inches (56 cm) and approx. 3 to 3.5 inches (7-8 cm) in section. If you can weigh your wood, aim for around 1.0 kg. The maximum moisture content of the wood should be around 20%.

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

Starting the First Fire

The initial fire should be small, so that the stove paint can cure and the main plates of the stove can settle into position. Some fumes will be given off by the paint. Ventilate the room during this phase.

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

In principle

Your stove is fitted wih Primary and Secondary air inlets.

Primary Air is controlled using the lever situated under the ash lip of the stove. Moving the control lever into a downward position will open the air inlet and will allow a supply of preheated air to enter the firebox via the 'airwash' system situated inside the stove and the above glass.

Secondary Air is right to the firebox using the specially designed baffle at the back of the firebox. The secondary air is injected into the flue gases both above and in front of 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. When not in use the handle can be stored using the lug by the right leg of the stove.

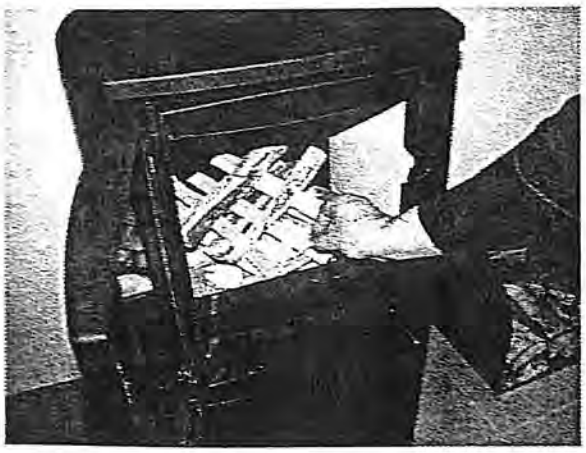
2.2 Lighting and loading intervals

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 doors is open, do not leave the stove unattended.

To form a reasonable bed of ash on the floor of the stove, you should use 5-6 inches thickness (2-4 pound) of dry kindling at the initial lighting. Always maintain a 1-1.5 inch (2-3 cm) layer of ash on the floor of the combustion chamber at all other times.

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 above).
3. After lighting, partially close the doors, leaving them open an inch or two to allow in plenty of combustion air.
4. When the chimney is warmed through after 5-10 minutes, the doors should be closed. A suitable ember bed will be formed after a further 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 (see dimensions above) onto the embers. Leave half an inch (1 cm) or more between each piece. When using 10 inches (25 cm) logs, place the ends of your logs towards the opening, but not too close to the front.



7. Close the door. Leave the primary air supply fully open.
8. After a few minutes, and adjust the primary air supply to suit your heating requirements.
9. Anticipate each refueling, remembering to add a modest 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 doors open.

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

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

Draft conditions

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

Rules of woodburning

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

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

3.0 MAINTENANCE

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

3.1 Exterior Maintenance

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

3.2 Internal maintenance

Glass

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

Reasons for dirty glass

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

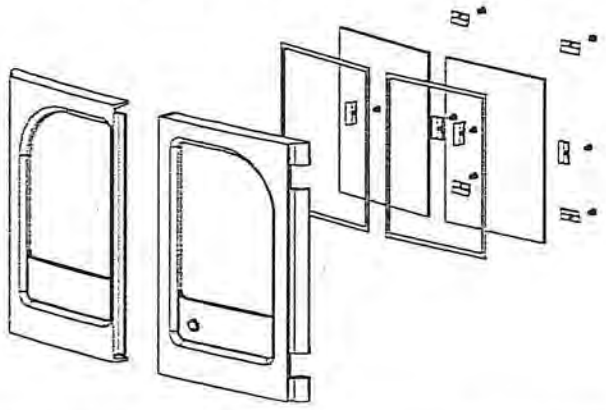
Replace broken glass immediately. **Do not operate your stove if the glass in the door is damaged.**

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

Installing the glass

Never install the glass when the stove is in function.

1. Lift the door off its hinges an place face-down on a sheet of cardboards or other non-abrasieve fabric.



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

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

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

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

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

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

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

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

All of these service parts can be bought from your morsø dealer, and we recommend that damaged parts are replaced as soon as possible to avoid collateral damage.
Should the baffle be distorted by an overfire, the stove will still function, although its efficiency may be compromised. Replace it as soon as possible. The radiation shield on the back of the stove is first removed by loosening the 4 screws. The rear casing is removed (four bolts). Remove these and remove the 2 M8 bolts keeping the baffle plate. withdraw the baffle from the firebox.
Before replacing the baffle, scrape out the old fire furnace and replace with new to make an effective seal.

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

Ceramic Gasket
The gasket around the perimeter of the doors 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. - at least once a year. Inspect every month.
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 ocurred during the off season.

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

Empty the ashpan according to this procedure:
Open the front doors, and use a shovel or poker to stir excess ash through the ash slots in the grate down into the ash pans. Remove the ash pans, making sure to keep it level.

grate down into the ash pans. Remove the ash pans, making sure to keep it level.
Dispose the ash in a metal container with a tight fitting lid.
The closed container of ashes should be placed on a noncombustible floor or on the ground, well away from all combustible materials, pending final disposal. If the ashes are disposed of by burial in soil or otherwise locally disperded, they should be retained in the closed container until all cinders have thoroughly cooled.
Return the ash pans to its original position in the stove, and close.

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, inspect the chimney connector periodically to determine if a creosote buildup has occurred.

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

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

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

3.4 Leaving the stove for extended periods

Important:

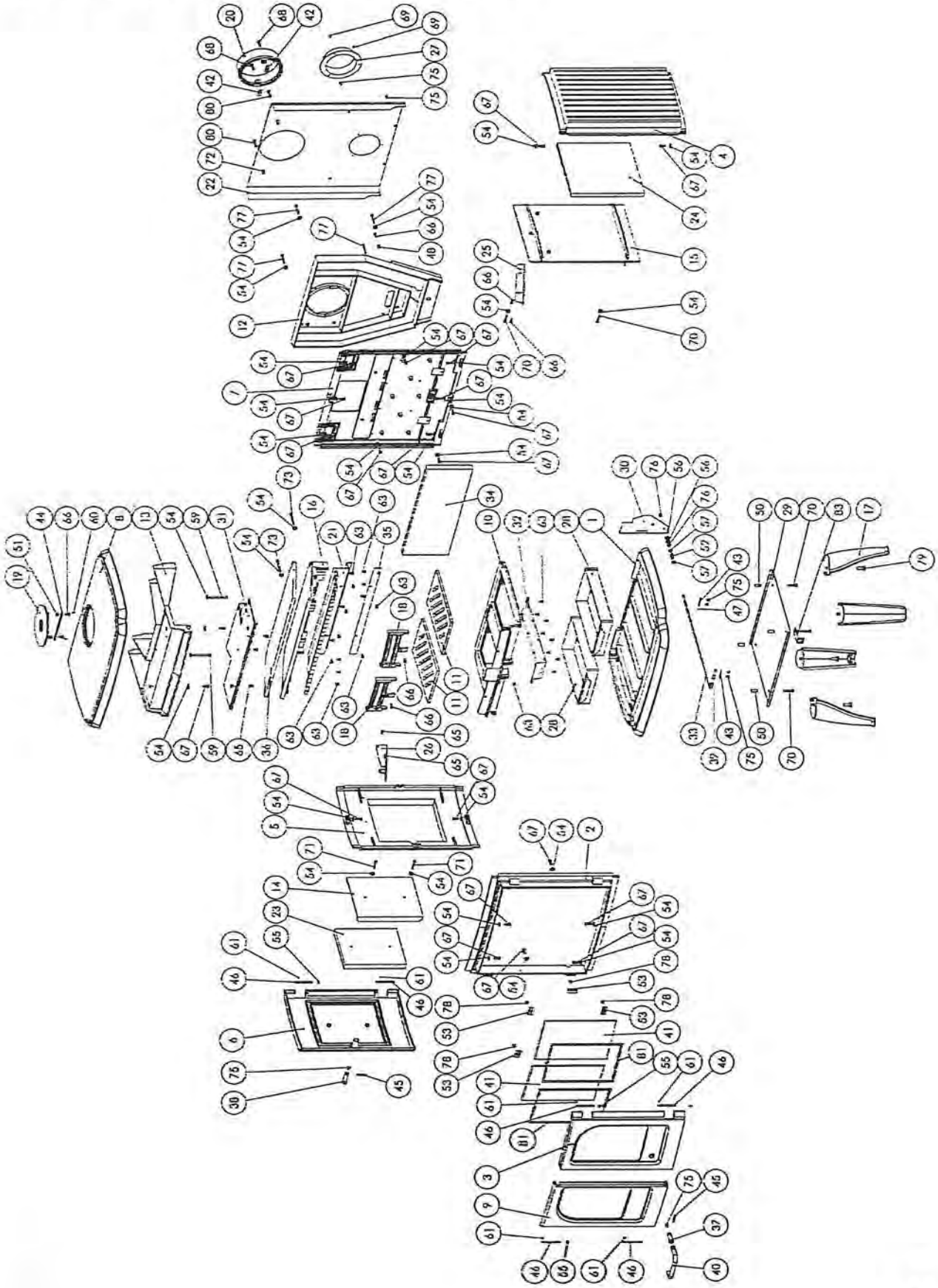
If the stove is to be left unused for any period of time, clean it out thoroughly and leave the air control slightly open to allow airflow. Make sure that the flue does not allow rainwater to come anywhere near the stove; install a chimney cap, but do not block off the flue completely.
These measures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

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

Thank you for buying a morsø stove.

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

3.5 Parts diagram for model Morsø 3600



3.6 Parts list for model Morsø 3600

Pos.No.	Parts
1	Base plate
2	Front frame
3	Door right
4	Side plate
5	Side frame
6	Door side
7	Inside rear plate
8	Top plate
9	Door left
10	Intermediate frame
11	Grate
12	Outside back plate
13	Inside top plate
14	Fire plate for side door
15	Fire plate for side plate
16	Baffle plate, cast iron
17	Leg
18	Front grate
19	Cover
20	Flue collar
21	Baffle plate, stainless
22	Convection rear plate
23	Stone side door
24	Stone side plate
25	Angle brace f. fire plate
26	Angle brace f. sideframe (Lefthand sidedoor)
27	Airadaptor
28	Ash tray
29	Radiant shielding, bottom
30	Draught control
31	Baffle plate, stainless, inside top
32	Plate for intermediate frame
33	Air inlet arm
34	Stone back
35	Securing bracket f. back brick
36	Insulation
37	Axis for handle
38	Axis for handle
39	Stainless handle for adjustment
40	Door handle, stainless steel
41	Ceramic glass
42	Fitting w. thread for flue collar
43	Assemble steel
44	Flat bar
45	Hinge pin
46	Hinge pin
47	Cotter pin

48	Distance tube
50	Distance tube
51	Distance tube
52	Pressure spring, stainless
53	Glass fitting
54	Washer
55	Washer
56	Washer
57	Washer
59	Screw
60	Screw
61	Screw
63	Screw
65	Screw
66	Screw
67	Screw
68	Screw
69	Screw
70	Screw
71	Screw
72	Distance tube
73	Screw
74	Screw
75	Screw
76	Nuts
77	Screw
78	Screw
79	Screw
80	Screw
81	Tightening tape
83	Hanging for handle

APPENDIX H

1. TUNNEL FLOW RATE

Tunnel flow rates are determined using the velocity pressure measurement made by a standard Pitot tube. The Pitot tube is located at the center of the dilution tunnel. Three x/y axis traverses were used to determine the relationship between the center velocity pressure and the average obtained by traversing. This procedure was carried out in accordance with EPA Method 2.

Velocity pressure and tunnel temperature data are used to calculate tunnel velocity via EPA Method 2, equation 2-9 as follows:

$$T_v = K_p * C_p * \sqrt{\Delta P} * \sqrt{\frac{T_s}{P_s * M_s}}$$

Where:

K_p = 85.49 (English units constant for ft/sec.)
F_p = Pitot tube center point coefficient determined from traverses
C_p = .99 Coefficient for standard pitot tube
ΔP = Pitot tube velocity pressure (in. w.c.)
Ts = Absolute tunnel temperature (1R)
Ps = Absolute tunnel pressure (in. Hg)
Ms = Mole. Wt. of tunnel gas stream (lb./lb.-mole, wet basis) = 29 * (1-.04) + 18 * .04 =28.56
T_v = Tunnel velocity (ft./sec.)

Tunnel flow is calculated by multiplying the average velocity as calculated by the above formula by the following equation (adaptation of EPA Method 2, formula 2-10).

$$T_f = \overline{T_v} * 60 * 0.1961 * \frac{528}{TT_{ave}} * \frac{PS}{29.92} * 1 - .04$$

Where:

$\overline{Tv}$ = Average tunnel velocity (ft/sec.)
0.1961 = Tunnel cross sectional area (ft5)
T_f = Tunnel flow rate (SCFM)
TT_{ave} = Average tunnel temp. (1R)
PS = Average barometric pressure during test.
60 = sec. to min. conversion
0.04 = Assumed tunnel moisture content (4% by Vol.)

2. EMISSIONS RATE CALCULATION

Emissions rates are calculated from the total weight gain of the probe and first and second filters of each sampling system as follows:

$$ER = \left(\frac{T_f * Wt.Gain * 60}{vol.sampled} \right)_{0.83} * 1.82$$

Where: ER = Emissions rate (grams/hour OM7 equivalent)
Vol. Samp. = Total volume sampled (SCFM, Dry)
Wt. Gain = Total weight gain for filter system (grams)
T_f = Tunnel flow rate (SCFM, Dry)

3. CORRECTIONS TO STANDARD CONDITIONS

The tunnel flow rate is corrected to standard conditions through the EPA Method 2 formulae. The volume sampled is measured by dry gas meters and must be corrected for meter temperature and ambient barometric pressure. The inlet and outlet temperatures of each dry gas meter are measured and recorded at 10-minute intervals during the test. The ambient barometric pressure is recorded at the beginning and end of each test.

The following formula is used to correct the total volume as measured by the dry gas meter to total volume at standard conditions (681F, 29.92 in. Hg):

$$VOL_{std} = VOL_m * \frac{PS}{29.92} * \frac{528}{AMT} * Y$$

Where: $VOL_{std.}$ = Total volume in Standard Cubic Feet
VOL_m = Total volume as measured by dry gas meter.
PS = Average barometric pressure
AMT = Average meter temperature (1R)
Y = Dry gas meter calibration factor

EXAMPLE CALCULATIONS

1. TUNNEL VELOCITY

INPUTS: P =.038 in. w.c.
T_s = 1001F
P_s = 29.3 in. Hg.
M_s = 28.56 lb./lb.-mole
C_p = .99
F_p = .945

$$T_v = 85.49 * .99 * .945 * \sqrt{.038} * \sqrt{\frac{560}{29.3 * 28.56}} = 12.754$$

2. TUNNEL FLOW RATE

INPUTS: T_v = 12.754 ft./sec.
TT_{ave} = 5601R
PS = 29.3 in. Hg.

$$T_f = 12.754 * 60 * 0.1961 * \frac{528}{560} * \frac{29.3}{29.92} * (1 - .04) = 133.0 SCFM$$

3. EMISSIONS RATE

INPUTS: T_f = 133.0 SCFM
Wt. Gain = .0200 grams
Vol. Samp. = 100 Std. cubic feet

$$ER = \left(\frac{133 * .0200 * 60}{100}\right)^{.83} * 1.82 = 2.68 grams / hour$$

4. VOLUME CORRECTION FOR DRY GAS METERS

INPUTS: VOL_m = 104.479 (Metered Feet3)
PS = 29.3 (Average baro. pressure)
AMT = 801F (Ave. meter temp.) = 5401R
Y = .9996 (Meter cal. factor)

$$VOL_{std} = 104.479 * \frac{29.3}{29.92} * \frac{528}{540} * .9996 = 100.00 S\tan dardFt_3$$

APPENDIX I

Manufacturer:	Morso
Model:	3600
Date:	8/6/01
Run:	1
Control #:	J20049092
Test Duration:	270

	Start	End
Barometer (in.Hg):	29.3	29.3
Wet Bulb (F):		
Dry Bulb (F):	74	79
Humidity (%):	84	63

Average Stove Temperature:	#DIV/0!					
oisture content of wood (wet basis):	17.36					
Average	1.16	7.53	12.12	336.11	90.00	
*	*	*	*	*	*	
Elapsed Time	Weight Remaining	CO	CO_2	O_2	Flue Gas	Room Temp
0	14.87	1.23	7.15	12.31	375	90
10	13.00	1.70	5.17	14.11	438	90
20	11.40	0.33	13.44	6.46	521	90
30	9.40	0.35	13.98	6.35	536	90
40	7.70	0.65	14.79	5.47	547	90
50	6.40	0.39	14.01	6.16	522	90
60	5.40	0.97	10.09	9.66	458	90
70	4.70	1.51	7.63	11.81	389	90
80	4.10	1.28	7.65	11.93	358	90
90	3.50	1.16	8.24	11.31	358	90
100	3.00	0.58	8.52	11.13	353	90
110	2.70	0.36	7.85	11.93	332	90
120	2.40	0.49	7.44	12.40	315	90
130	2.30	0.74	7.26	12.47	305	90
140	2.10	0.89	6.72	12.96	292	90
150	2.00	0.87	6.52	13.21	280	90
160	1.80	1.01	6.27	13.43	273	90
170	1.70	1.31	6.02	13.54	270	90
180	1.60	1.46	5.84	13.71	266	90
190	1.40	1.70	5.41	14.06	259	90
200	1.30	1.65	5.29	14.16	253	90
210	1.20	1.61	5.18	14.24	249	90
220	1.00	1.58	5.18	14.32	246	90
230	0.90	1.75	5.12	14.30	247	90
240	0.60	1.84	4.94	14.49	247	90
250	0.30	1.85	4.87	14.63	241	90
260	0.10	1.64	5.11	14.48	242	90
270	0.00	1.56	5.17	14.43	239	90

Warnock Hersey Efficiency Test Report

Overall Heating Efficiency:			67.71%	
Combustion Efficiency:			90.76%	
Heat Transfer Efficiency:			74.61%	
Heat Output:	16303	BTU/Hr	17186	KJ/Hr
Heat Input:	24076	BTU/Hr	25381	KJ/Hr
Burn Duration:	4.50	Hours		
Burn Rate:	2.73	Lb/Hr	1.239	Kg/Hr
Stack Temp:	336.1	Deg.F	168.9	Deg.C

-0.06163	0.34342588	#DIV/0!	#DIV/0!	7.34471	0.599
Comb	Combust	Heat	Net	*	*
%	Eff	Transfer	Eff	air	Unit
K	%	Transfer	Eff	Fuel	MN
0.04	90.9%	22.7%	20.6%	8	6.75
0.49	74.2%	36.1%	26.8%	11	5.90
1.99	75.6%	57.7%	43.6%	6	5.17
2.48	72.2%	64.6%	46.7%	6	4.26
2.05	77.3%	71.0%	54.9%	6	3.49
0.81	89.4%	75.8%	67.7%	7	2.90
-0.04	95.8%	77.1%	73.8%	10	2.45
-0.34	97.2%	78.3%	76.1%	13	2.13
-0.47	101.3%	80.8%	81.8%	15	1.86
-0.68	106.4%	82.5%	87.8%	15	1.59
-1.06	119.8%	83.7%	100.3%	18	1.36
-1.10	125.4%	84.1%	105.5%	21	1.23
-0.93	120.6%	84.8%	102.2%	22	1.09
-0.88	116.9%	85.2%	99.5%	22	1.04
-0.83	115.3%	85.4%	98.4%	24	0.95
-0.79	114.6%	85.8%	98.4%	25	0.91
-0.72	111.5%	86.1%	96.0%	26	0.82
-0.66	107.0%	86.2%	92.2%	26	0.77
-0.56	102.6%	86.3%	88.6%	26	0.73
-0.47	97.9%	86.4%	84.6%	27	0.64
-0.53	100.2%	86.6%	86.8%	29	0.59
-0.60	102.8%	86.7%	89.1%	31	0.54
-0.51	100.2%	87.2%	87.4%	31	0.45
-0.47	97.4%	87.3%	85.0%	31	0.41
-0.37	93.3%	87.4%	81.6%	33	0.27
-0.25	89.4%	88.2%	78.8%	34	0.14
-0.28	92.3%	88.6%	75.7%	36	0.05
-0.32	94.3%	88.9%	83.8%	37	0.00

Manufacturer:	Morso
Model:	3600
Date:	8/8/01
Run:	2
Control #:	J20049092
Test Duration:	370

	Start	End
Barometer (in.Hg):	29.28	29.26
Wet Bulb (F):		
Dry Bulb (F):	75	80
Humidity (%):	72	67

Average Stove Temperature: #DIV/0!

oisture content of wood (wet basis): 16.96

	Weight Remaining	CO	CO_2	O_2	Flue Gas	Room Temp
Average	1.19	6.43	13.19	301.84	88.87	
*	*	*	*	*	*	
Elapsed Time						
0	15.54	0.51	7.90	11.90	324	90
10	14.10	0.84	5.96	14.01	434	90
20	12.9	0.4	11.03	9.28	480	90
30	11.40	0.35	13.72	6.91	515	90
40	10.20	0.48	14.20	6.35	527	89
50	8.60	0.48	14.74	5.59	544	90
60	6.80	0.28	13.09	7.30	509	90
70	5.90	0.49	9.51	10.65	439	90
80	5.30	0.60	8.90	11.20	406	90
90	5.00	0.91	8.61	11.28	393	90
100	4.70	0.77	7.27	12.51	351	90
110	4.40	0.66	7.03	12.73	332	89
120	4.20	0.40	6.99	12.96	315	89
130	4.00	0.63	6.57	13.21	301	90
140	3.80	0.74	6.59	13.11	294	90
150	3.60	0.87	6.01	13.74	281	89
160	3.50	0.85	5.77	13.95	268	89
170	3.30	1.08	5.54	14.08	263	89
180	3.20	1.22	5.47	14.08	257	89
190	2.90	1.18	5.55	14.00	254	89
200	2.70	1.41	5.29	14.17	250	88
210	2.60	1.32	5.32	14.26	247	88
220	2.40	1.42	5.24	14.21	246	88
230	2.20	1.65	4.66	14.58	241	88
240	2.10	1.82	4.46	14.70	237	89
250	1.90	1.83	4.40	14.76	233	88
260	1.80	1.72	4.29	14.95	231	88
270	1.60	1.90	3.93	15.15	225	88
280	1.50	1.83	4.42	14.83	223	88
290	1.20	1.88	4.01	15.14	218	88
300	1.10	1.84	3.68	15.54	213	88
310	1.00	1.77	3.51	15.66	208	88
320	0.80	1.85	3.45	15.73	204	88
330	0.70	1.88	3.44	15.74	202	88
340	0.60	1.87	3.28	15.88	200	88
350	0.40	1.68	3.60	15.77	202	88
360	0.20	1.89	3.47	15.72	201	88
370	0.00	1.86	3.48	15.73	202	88

Warnock Hersey Efficiency Test Report

Overall Heating Efficiency:			69.36%	
Combustion Efficiency:			91.47%	
Heat Transfer Efficiency:			75.83%	
Heat Output:	12678	BTU/Hr	13364	KJ/Hr
Heat Input:	18277	BTU/Hr	19267	KJ/Hr
Burn Duration:	6.17	Hours		
Burn Rate:	2.09	Lb/Hr	0.949	Kg/Hr
Stack Temp:	301.8	Deg.F	149.9	Deg.C

-0.10742	0.47977042	#DIV/0!	#DIV/0!	11.9425	0.886
Comb	Combust	Heat	Net	*	*
%	Eff	Transfer	Eff	air	Unit
K	%	Transfer	Eff	Fuel	MN
-0.09	98.5%	33.8%	33.3%	8	7.05
0.64	77.7%	35.5%	27.6%	11	6.40
2.03	70.4%	49.6%	35.0%	6	5.85
3.21	64.7%	57.1%	36.9%	5	5.17
3.13	66.6%	62.5%	41.7%	5	4.63
2.25	75.7%	69.4%	52.5%	5	3.90
0.95	87.4%	75.1%	65.6%	7	3.09
0.12	95.3%	76.6%	73.0%	11	2.68
-0.08	98.0%	78.4%	76.9%	12	2.40
-0.19	98.1%	79.2%	77.7%	12	2.27
-0.58	107.9%	80.0%	86.3%	16	2.13
-0.76	113.9%	81.0%	92.3%	18	2.00
-0.75	116.7%	82.0%	95.7%	19	1.91
-0.82	117.3%	82.4%	96.7%	20	1.81
-0.86	117.1%	83.1%	97.3%	20	1.72
-0.72	112.9%	83.1%	93.8%	22	1.63
-0.79	115.9%	83.6%	96.9%	23	1.59
-0.75	112.5%	83.8%	94.3%	24	1.50
-0.73	110.6%	84.2%	93.1%	24	1.45
-0.78	112.4%	84.8%	95.4%	25	1.32
-0.72	108.4%	84.9%	92.1%	25	1.23
-0.64	106.8%	85.3%	91.1%	26	1.18
-0.73	108.9%	85.4%	93.0%	27	1.09
-0.83	110.5%	85.0%	93.9%	30	1.00
-0.80	107.7%	85.1%	91.6%	30	0.95
-0.79	107.4%	85.4%	91.7%	31	0.86
-0.78	108.4%	85.4%	92.6%	33	0.82
-0.84	109.2%	85.3%	93.1%	36	0.73
-0.67	102.9%	86.6%	89.2%	32	0.68
-0.75	105.9%	86.4%	91.5%	37	0.54
-0.70	104.6%	86.2%	90.1%	40	0.50
-0.82	111.3%	86.1%	95.8%	44	0.45
-0.73	106.3%	86.5%	92.0%	45	0.36
-0.70	104.6%	86.8%	90.8%	45	0.32
-0.74	106.5%	86.6%	92.2%	48	0.27
-0.60	102.8%	87.5%	89.9%	47	0.18
-0.65	102.3%	87.5%	84.2%	48	0.09
-0.64	102.1%	87.6%	89.4%	50	0.00

Manufacturer:	MORSO
Model:	3600
Date:	8/8/01
Run:	3
Control #:	
Test Duration:	85

	Start	End
Barometer (in.Hg):	29.04	29.03
Wet Bulb (F):		
Dry Bulb (F):	74	86
Humidity (%):	79	61

Average Stove Temperature: #DIV/0!

oisture content of wood (wet basis): 18.32

	Average	0.19	9.10	11.04	714.70	89.80	-0.01231	0.10465447	#DIV/0!	#DIV/0!	1.99657	0.244
*	*	*	*	*	*	*	Comb	Combust	Heat	Net	*	*
Elapsed	Weight				Flue	Room	%	Eff	Transfer	Eff	air	Unit
Time	Remaining	CO	CO_2	O_2	Gas	Temp	K	%	Transfer	Eff	Fuel	MN
0	15.69	0.02	0.19	19.79	658	88	-1.37	-107.2%	-3.9%	4.2%	-61	7.12
10	11.20	0.25	19.71	0.41	1046	90	3.71	70.7%	44.5%	31.5%	4	5.08
20	7.30	0.10	18.20	1.66	999	90	0.94	91.2%	64.0%	58.4%	5	3.31
30	3.70	0.04	13.65	6.13	855	90	-1.14	116.1%	72.7%	84.3%	11	1.68
40	2.30	0.06	9.06	10.99	732	90	-0.98	122.1%	70.5%	86.1%	20	1.04
50	1.60	0.07	7.38	12.92	659	90	-0.67	118.3%	69.3%	81.9%	27	0.73
60	1.00	0.11	6.86	13.58	606	90	-0.44	112.1%	70.3%	78.8%	30	0.45
70	0.60	0.25	5.70	14.68	554	90	-0.43	112.7%	68.9%	77.7%	39	0.27
80	0.20	0.42	5.23	15.07	527	90	-0.36	108.6%	68.7%	66.1%	43	0.09
85	0.00	0.58	5.04	15.22	511	90	-0.27	103.2%	69.0%	71.2%	44	0.00

Warnock Hersey Efficiency Test Report

Overall Heating Efficiency:			59.14%	
Combustion Efficiency:			77.07%	
Heat Transfer Efficiency:			76.74%	
Heat Output:	49937	BTU/Hr	52642	KJ/Hr
Heat Input:	84437	BTU/Hr	89012	KJ/Hr
Burn Duration:	1.42	Hours		
Burn Rate:	9.05	Lb/Hr	4.104	Kg/Hr
Stack Temp:	714.7	Deg.F	379.3	Deg.C

Manufacturer:	Morso
Model:	3600
Date:	8/9/01
Run:	4
Control #:	J20049092
Test Duration:	193

	Start	End
Barometer (in.Hg):	29	28.96
Wet Bulb (F):		
Dry Bulb (F):	73	74
Humidity (%):	63	70

Average Stove Temperature:	#DIV/0!
oisture content of wood (wet basis):	17.02

	Average	0.61	6.73	13.29	438.62	88.10
*	*	*	*	*	*	*

Elapsed Time	Weight Remaining	CO	CO_2	O_2	Flue Gas	Room Temp
0	15.61	0.32	5.00	14.90	431	84
10	13.50	1.20	5.78	14.33	486	85
20	11.60	0.18	10.80	9.37	601	85
30	9.40	0.50	14.26	5.87	688	87
40	7.40	0.43	12.19	7.94	636	88
50	5.10	0.23	10.98	9.19	594	89
60	4.20	0.13	9.39	10.67	554	90
70	3.50	0.41	7.38	12.65	497	90
80	2.90	0.35	6.19	13.63	451	89
90	2.60	0.38	5.72	14.34	409	89
100	2.40	0.46	5.66	14.45	390	89
110	2.10	0.51	5.68	14.43	376	89
120	1.90	0.62	5.36	14.68	368	89
130	1.50	0.59	5.51	14.58	365	88
140	1.30	0.70	5.24	14.76	358	88
150	1.10	0.87	4.80	15.15	351	89
160	0.80	1.01	4.71	15.11	344	88
170	0.50	1.01	4.54	15.37	339	88
180	0.30	1.02	4.15	15.73	330	88
190	0.10	1.02	4.08	15.87	323	89
193	0.00	0.94	3.95	16.03	320	89

Warnock Hersey Efficiency Test Report

Overall Heating Efficiency:			65.26%	
Combustion Efficiency:			92.15%	
Heat Transfer Efficiency:			70.82%	
Heat Output:	23263	BTU/Hr	24524	KJ/Hr
Heat Input:	35646	BTU/Hr	37577	KJ/Hr
Burn Duration:	3.22	Hours		
Burn Rate:	4.03	Lb/Hr	1.827	Kg/Hr
Stack Temp:	438.6	Deg.F	225.9	Deg.C

-0.0452	0.27222877	#DIV/0!	#DIV/0!	7.04944	0.492
Comb	Combust	Heat	Net	*	*
%	Eff	Transfer	Eff	air	Unit
K	%	Transfer	Eff	Fuel	MN
-0.53	115.8%	27.1%	31.3%	15	7.08
1.36	61.7%	27.1%	16.7%	10	6.13
1.59	76.0%	52.6%	39.9%	7	5.26
2.22	74.9%	61.3%	45.9%	6	4.26
0.89	86.8%	68.4%	59.4%	7	3.36
-0.25	102.8%	74.5%	76.6%	10	2.31
-0.75	114.3%	75.6%	86.4%	14	1.91
-0.70	114.6%	75.3%	86.3%	19	1.59
-1.08	132.6%	75.7%	100.3%	27	1.32
-0.76	122.3%	76.7%	93.8%	29	1.18
-0.64	116.8%	77.8%	90.9%	29	1.09
-0.60	114.8%	79.0%	90.6%	30	0.95
-0.61	114.4%	78.8%	90.2%	32	0.86
-0.55	112.7%	79.7%	89.8%	33	0.68
-0.58	113.0%	79.6%	89.9%	35	0.59
-0.51	108.8%	79.0%	86.0%	38	0.50
-0.55	108.9%	79.5%	86.6%	40	0.36
-0.42	104.0%	79.5%	82.6%	42	0.23
-0.45	105.5%	78.8%	83.1%	47	0.14
-0.35	101.1%	79.2%	73.5%	49	0.05
-0.38	103.5%	78.9%	81.6%	52	0.00

APPENDIX J

ITS Intertek Testing Services

Page ___ of ___

Manufacturer Morso Model 3600 Wood Stove Date 8/3/01

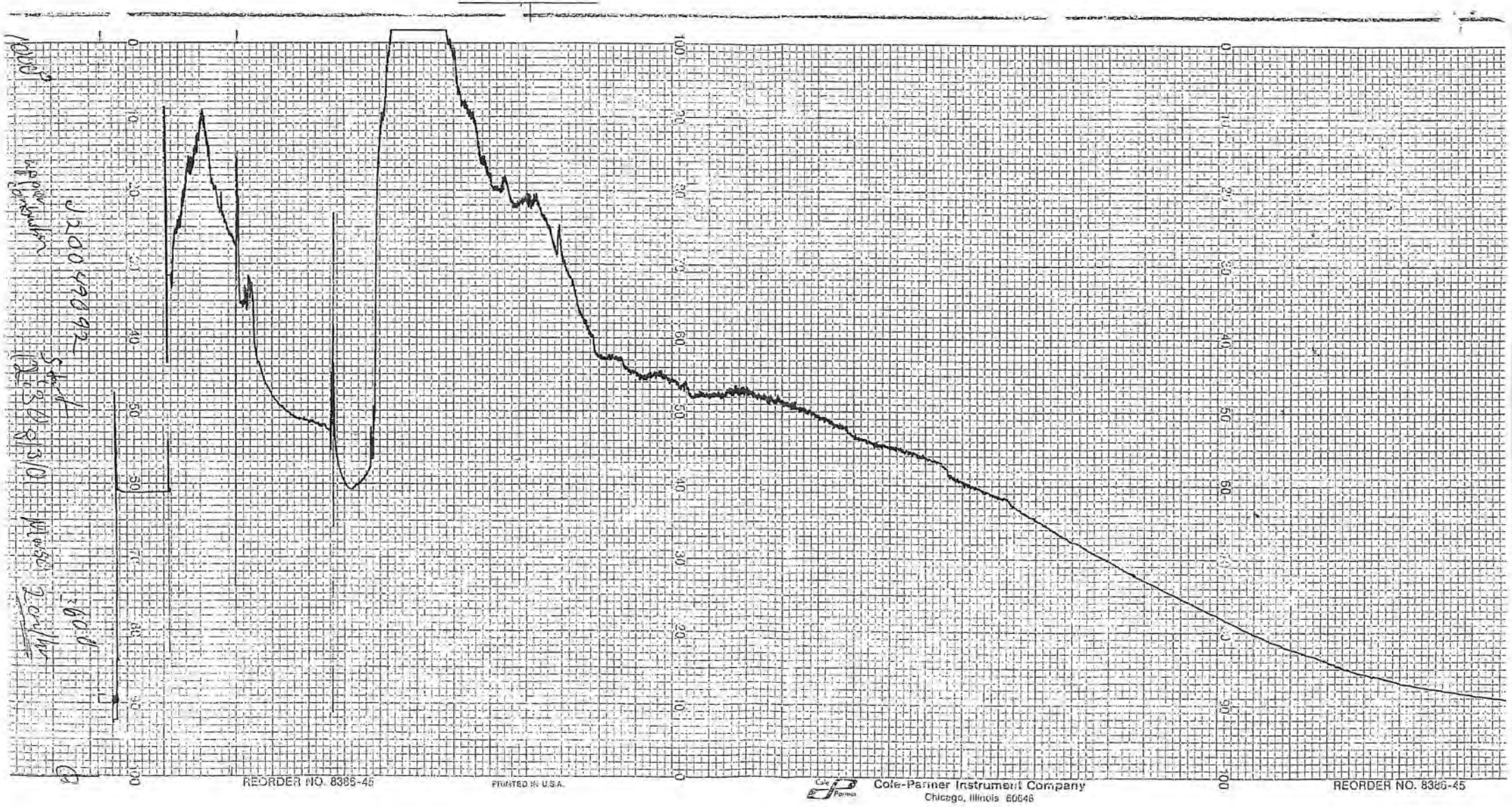
Job # J20049092 Tech WL

Break-in Data log

Type of fuel used: Red Oak
Moisture content corrected to 2-pin and for the type of fuel used.

Catalytic ___ Non-catalytic X

Date	Time	Flue Temp	Comb. Cham. Or Catalyst Temp	lbs. Fuel weight added	Moisture content
8/3/01	12:25	84	84	3.5 K. Kindling	
8/3/01	12:30	387	590	17.5	19.8
8/3/01	14:08	552	836	12.08	20.1
8/3/01	15:28	792	600	21.6	21.0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