## Agratechniek b.v.

#### DRYING INSTALLATIONS & EQUIPMENT

## 2023

# Drying installations with processor for seed

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#### **DRYING INSTALLATIONS & EQUIPMENT**

The company Agratechniek was founded in 1974. The objective then and now was and is the development, production and sale of drying and storage systems for the seed industry and growers, flowerbulb growers, MAP growers and arable farmers.

From the very beginning, we have been listening closely to the demands of our users and have been responding to their questions and ideas by providing practical and reliable installations and equipment. Thanks to a servicefocused attitude, the quality of advice and products, the know-how and the flexibility.

Agratechniek is a very strong player in various markets throughout the world, but always immediately in your vicinity.

In this brochure you'll find information about (automatically) drying of seed.

Absolute Humidity of air	
Equilibrium Moisture content of seeds	5
Seed names in other languages	6
Box drying installations bulk	
Examples of ABC software	
Drying and storage boxes for seed	
Conditioned drying in drying rooms	14
Drying with dehumidified air	
Central air dryer with ABC processor	
Hybrid air dryer for drying in closed cells	
Conditioned seed vault	
Seed humidification in boxes	
Drying by weight	
Individual box dryer	
ABC software for individual box dryers	
Efficient and economical drying	
Conditioned box dryer	
Fluid drying in boxes	
Intensive or fluid drying in boxes	
Fluid drying of fruit seeds and small amounts of treated seed	
Open drawer dryer	
Conditioned tray dryer	
Mobile bins for aeration and drying	
Individual drum dryer	50
Economically drying of fruit seeds	52





This table shows the Absolute (real) Moist content/Humidity (AH) in the air, related to the different temperatures (T°) and relative Humidity (RH) of the air. AH is in grams per kg air (about 1.1-1.2m<sup>3</sup>). On top (horizontal) the different RH values. And on the left and right column (vertical) you see the temperature.

Moisture will stay in the air because moisture molecules can move. They can move thanks to the energy in the air. Warm air has more energy and therefore can hold more moisture than cold air. When the air is saturated with moisture (AH maximum) we say; we have 100% moisture content. A lower AH is reported in relation to the maximum moisture content; so 40% RH means that the air contains out of 40% moisture related to the maximum moisture content at that Temperature. Also: Air with 30% RH at 20°C (68°F) is much drier than Air with 30% at 30°C (86°F) (4,4 to 8.15 gr/kg air). Only RH gives no information of the moisture content when temperature is not mentioned!

Absolu	Absolute moist content of air (g water / kg air) % Relative Humidity (RH)																						
T° (	C/F	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	T	C/F
2°   3	5.6°	0,22	0,44	0,65	0,87	1,09	1,31	1,53	1,74	1,96	2,18	2,40	2,62	2,83	3,05	3,27	3,49	3,71	3,92	4,14	4,36	2°	35.6°
3°   3	37.4°	0,23	0,47	0,70	0,94	1,17	1,40	1,64	1,87	2,11	2,34	2,57	2,81	3,04	3,28	3,51	3,74	3,98	4,21	4,45	4,68	3°	37.4°
4°   3	9.2°	0,25	0,50	0,75	1,01	1,26	1,51	1,76	2,01	2,26	2,52	2,77	3,02	3,27	3,52	3,77	4,02	4,28	4,53	4,78	5,03	4°	39.2°
5°   4	1.0°	0,27	0,54	0,81	1,08	1,35	1,62	1,89	2,16	2,43	2,70	2,97	3,24	3,51	3,78	4,05	4,32	4,59	4,86	5,13	5,40	5°	<b>41.0°</b>
6°   4	12.8°	0,29	0,58	0,87	1,16	1,45	1,74	2,03	2,32	2,61	2,90	3,18	3,47	3,76	4,05	4,34	4,63	4,92	5,21	5,50	5,79	6°	42.8°
7°   4	14.6°	0,31	0,62	0,93	1,24	1,55	1,86	2,17	2,48	2,79	3,11	3,42	3,73	4,04	4,35	4,66	4,97	5,28	5,59	5,90	6,21	7°	44.6°
8°   4	16.4°	0,33	0,67	1,00	1,33	1,66	2,00	2,33	2,66	2,99	3,33	3,66	3,99	4,32	4,66	4,99	5,32	5,65	5,99	6,32	6,65	8°	46.4°
9°   4	<b>8.2°</b>	0,36	0,71	1,07	1,42	1,78	2,14	2,49	2,85	3,20	3,56	3,92	4,27	4,63	4,98	5,34	5,70	6,05	6,41	6,76	7,12	9°	48.2°
10°	50.0°	0,38	0,76	1,14	1,52	1,91	2,29	2,67	3,05	3,43	3,81	4,19	4,57	4,95	5,33	5,72	6,10	6,48	6,86	7,24	7,62	<b>10°</b>	50.0°
11°   !	51.8°	0,41	0,82	1,22	1,63	2,04	2,45	2,86	3,26	3,67	4,08	4,49	4,90	5,30	5,71	6,12	6,53	6,94	7,34	7,75	8,16	<b>11°</b>	51.8°
12°   !	53.6°	0,44	0,87	1,31	1,74	2,18	2,62	3,05	3,49	3,92	4,36	4,80	5,23	5,67	6,10	6,54	6,98	7,41	7,85	8,28	8,72	12°	53.6°
13°   !	55.4°	0,47	0,93	1,40	1,86	2,33	2,80	3,26	3,73	4,19	4,66	5,13	5,59	6,06	6,52	6,99	7,46	7,92	8,39	8,85	9,32	13°	55.4°
14°   !	57.2°	0,50	1,00	1,49	1,99	2,49	2,99	3,49	3,98	4,48	4,98	5,48	5,98	6,47	6,97	7,47	7,97	8,47	8,96	9,46	9,96	14°	57.2°
15°   5	59.0°	0,53	1,06	1,60	2,13	2,66	3,19	3,72	4,26	4,79	5,32	5,85	6,38	6,92	7,45	7,98	8,51	9,04	9,58	10,11	10,64	15°	59.0°
16°   (	60.8°	0,57	1,14	1,70	2,27	2,84	3,41	3,98	4,54	5,11	5,68	6,25	6,82	7,38	7,95	8,52	9,09	9,66	10,22	10,79	11,36	16°	60.8°
17°	62.6°	0,61	1,21	1,82	2,42	3,03	3,64	4,24	4,85	5,45	6,06	6,67	7,27	7,88	8,48	9,09	9,70	10,30	10,91	11,51	12,12	17°	62.6°
18°   (	64.4°	0,65	1,29	1,94	2,58	3,23	3,88	4,52	5,17	5,81	6,46	7,11	7,75	8,40	9,04	9,69	10,34	10,98	11,63	12,27	12,92	18°	64.4°
19°   (	66.2°	0,69	1,38	2,07	2,76	3,45	4,13	4,82	5,51	6,20	6,89	7,58	8,27	8,96	9,65	10,34	11,02	11,71	12,40	13,09	13,78	<b>19°</b>	66.2°
20°	68.0°	0,73	1,47	2,20	2,94	3,67	4,40	5,14	5,87	6,61	7,34	8,07	8,81	9,54	10,28	11,01	11,74	12,48	13,21	13,95	14,68	20°	68.0°
21°	69.8°	0,78	1,56	2,35	3,13	3,91	4,69	5,47	6,26	7,04	7,82	8,60	9,38	10,17	10,95	11,73	12,51	13,29	14,08	14,86	15,64	21°	69.8°
22°   3	71.6°	0,83	1,67	2,50	3,33	4,16	5,00	5,83	6,66	7,49	8,33	9,16	9,99	10,82	11,66	12,49	13,32	14,15	14,99	15,82	16,65	22°	71.6°
23°   3	73.4°	0,89	1,77	2,66	3,55	4,43	5,32	6,21	7,09	7,98	8,87	9,75	10,64	11,52	12,41	13,30	14,18	15,07	15,96	16,84	17,73	23°	73.4°
24°   3	75.2°	0,94	1,89	2,83	3,77	4,72	5,66	6,60	7,54	8,49	9,43	10,37	11,32	12,26	13,20	14,15	15,09	16,03	16,97	17,92	18,86	24°	75.2°
25°   3	77.0°	1,00	2,01	3,01	4,01	5,02	6,02	7,02	8,02	9,03	10,03	11,03	12,04	13,04	14,04	15,05	16,05	17,05	18,05	19,06	20,06	25°	77.0°
26°   3	78.8°	1,07	2,13	3,20	4,27	5,33	6,40	7,47	8,53	9,60	10,67	11,73	12,80	13,86	14,93	16,00	17,06	18,13	19,20	20,26	21,33	26°	78.8°
27°   8	80.6°	1,13	2,27	3,40	4,53	5,67	6,80	7,93	9,07	10,20	11,34	12,47	13,60	14,74	15,87	17,00	18,14	19,27	20,40	21,54	22,67	27°	80.6°
28°   8	82.4°	1,20	2,41	3,61	4,82	6,02	7,23	8,43	9,64	10,84	12,05	13,25	14,45	15,66	16,86	18,07	19,27	20,48	21,68	22,89	24,09	28°	82.4°
29°   8	84.2°	1,28	2,56	3,84	5,12	6,40	7,68	8,96	10,24	11,52	12,8	14,07	15,35	16,63	17,91	19,19	20,47	21,75	23,03	24,31	25,59	29°	84.2°
30°   8	86.0°	1,36	2,72	4,08	5,43	6,79	8,15	9,51	10,87	12,23	13,59	14,94	16,30	17,66	19,02	20,38	21,74	23,09	24,45	25,81	27,17	30°	86.0°
31°   8	87.8°	1,44	2,89	4,33	5,77	7,21	8,66	10,10	11,54	12,98	14,43	15,87	17,31	18,75	20,20	21,64	23,08	24,52	25,97	27,41	28,85	31°	87.8°
32°   8	89.6°	1,53	3,06	4,59	6,12	7,66	9,19	10,72	12,25	13,78	15,31	16,84	18,37	19,90	21,43	22,97	24,50	26,03	27,56	29,09	30,62	32°	89.6°
33°   9	91.4°	1,62	3,25	4,87	6,50	8,12	9,74	11,37	12,99	14,62	16,24	17,86	19,49	21,11	22,74	24,36	25,98	27,61	29,23	30,86	32,48	33°	91.4°
34°   9	93.2°	1,72	3,45	5,17	6,89	8,61	10,34	12,06	13,78	15,50	17,23	18,95	20,67	22,39	24,12	25,84	27,56	29,28	31,01	32,73	34,45	34°	93.2°
35°   9	95.0°	1,83	3,65	5,48	7,31	9,14	10,96	12,79	14,62	16,44	18,27	20,10	21,92	23,75	25,58	27,41	29,23	31,06	32,89	34,71	36,54	35°	95.0°
36°   9	96.8°	1,94	3,87	5,81	7,75	9,68	11,62	13,56	15,49	17,43	19,37	21,30	23,24	25,17	27,11	29,05	30,98	32,92	34,86	36,79	38,73	36°	96.8°
37°   9	98.6°	2,05	4,11	6,16	8,21	10,27	12,32	14,37	16,42	18,48	20,53	22,58	24,64	26,69	28,74	30,80	32,85	34,90	36,95	39,01	41,06	37°	98.6°
38°   1	00.4°	2,18	4,35	6,53	8,7	10,88	13,05	15,23	17,40	19,58	21,76	23,93	26,11	28,28	30,46	32,63	34,81	36,98	41,48	41,33	43,51	38°	100.4°
39°   1	02.2°	2,30	4,61	6,91	9,22	11,52	13,83	16,13	18,44	20,74	23,05	25,35	27,65	29,96	32,26	34,57	36,87	39,18	41,48	43,79	46,09	39°	102.2°
40°   1	.04.0°	2,42	4,84	7,27	9,69	12,11	14,53	16,95	19,38	21,80	24,22	26,64	29,06	31,49	33,91	36,33	38,75	41,17	43,60	47,02	48,44	40°	104.0°
T° C	C/F	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	T	C/F



Table down below gives a clear understanding of the equilibrium moisture (EM) of different crops. Moisture into seeds will be in balance with the moisture content of the surrounding air around the seeds. So the EM of the seeds is dependent on the moisture content of the surrounding air. The moisture content of the seeds will be high when the surrounding air has a high moisture content. Roughly you can say that the moisture content of the seeds will correspond with the EM of the surrounding air.

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When the moisture content of the seeds is higher than the surrounding, the moisture will be exuded to the surrounding air. The moist air must be evacuated and refreshed by dry air. This process must be proceeding till the seeds have reached the required EM.

Usually the relative moisture (RM) content of the seeds is measured to determine the moisture content of the seeds. <u>Please note</u>; this is only in relation when the temperature of the surrounding air is <u>25 °C (77°F)</u>! The EM will give a more secure result when the temperature can fluctuate.

With the ABC processor from Agratechniek you can dry the seeds automatically to the required EM by programming the corresponding RH or EM of the air.

R.V. at T=25°C (77°F)	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
A.V. (gr moist / kg air)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0
Alfalfa	4.8	5.6	6.4	7.1	7.8	8.4	9.0	9.5	10.0	10.8	11.7	12.8	14.0	14.5	15.0	15.5	16.0	16.5	17.0
Barley	6.2	6.0	6.8	7.5	8.3	9.0	9.8	10.6	11.4	12.3	13.2	14.1	15.0	16.1	17.2	19.4	22.7	24.6	26.5
Bean	4.7	5.7	6.8	7.6	8.5	9.3	10.1	10.8	11.6	12.3	13.1	13.9	14.8	15.9	17.2	19.5	22.6		
Bean, French		5.0	5.5	6.0	6.5	7.1	7.8	8.5	9.2	10.1	11.0	12.0	13.0	14.0	14.5	15.0	15.6	16.2	16.7
Bean, Lima	4.6	5.6	6.6	7.1	7.7	8.2	8.6	9.2	9.9	10.4	11.0	12.0	12.9	13.8	15.0	15.6	16.5	17.4	18.3
Bean, Snap	3.0	3.9	4.8	5.8	6.8	7.8	8.8	9.4	10.3	11.1	12.0	13.0	14.0	15.0	16.0	<b>16.7</b>	17.6	18.5	19.4
Beet	2.1	3.0	4.0	4.9	5.8	6.4	7.0	7.6	8.2	8.8	9.4	10.0	10.6	11.2	15.0	12.4	13.0	13.6	14.2
Beet, Garden	4.7	5.8	7.0	7.8	8.6	9.2	9.8	9.9	10.1	11.4	12.7	13.6	14.6	15.5	16.5	17.4	18.4	19.3	20.3
Buckwheat	5.7	6.7	7.6	8.1	9.1	9.8	10.5	10.8	11.4	12.0	12.7	13.5	14.2	15.0	16.5	17.5	19.1	21.8	24.5
Cabbage	3.2	3.5	4.6	5.0	5.4	5.7	6.1	6.4	6.9	7.3	7.6	8.3	8.9	9.6	10.0				
Cabbage, Chinese	2.4	2.9	3.4	4.0	4.6	5.2	6.0	6.3	7.1	7.4	7.8	8.2	8.8	9.4					
Capsicum		6.0	6.3	6.5	7.0	7.0	7.0	7.3	7.5	8.2	9.0	9.6	10.4	11.0					
Caraway	4.7	5.2	5.7	6.2	6.7	7.2	7.8	8.4	9.0	9.6	10.3	11.1	12.0	13.0	14.5	<b>16.5</b>	<b>19.8</b>		
Carrot	4.4	5.1	5.8	6.2	6.9	7.4	7.9	8.4	8.9	9.4	10.0	10.9	11.9	13.0	14.2				
Celery	5.8	6.4	7.0	7.4	7.8	8.2	8.6	9.0	9.5	10.0	10.4	11.0	11.7	12.4	13.5				
Chicory		_	4.5	5.5	6.5	7.0	7.5	8.1	8.3	8.6	8.9	9.2	9.5	10.6	11.7				
Chives	3.4	4.2	5.1	6.0	6.9	7.6	8.5	9.4	10.2	11.1	11.8	12.6	13.3	14.0	14.8	15.5	16.2	16.9	17.6
Clover, Red		5.7	6.3	6.9	7.6	8.2	8.8	9.4	10.0	10.7	11.4	12.1	9.1	11.2	15.6	18.7			
Clover, White		5.9	6.0	6.6	7.8	7.8	8.4	9.7					8.7	10.9	15.4	18.0			
Cocksfoot		6.0	6.6	7.4	8.0	8.9	9.8	10.3	10.8	11.3	11.8	12.4	13.4	14.4	16.6				
Corn, Dent	5.1	6.6	7.2	7.8	8.4	9.1	9.7	10.4	11.2	12.0	12.9	13.5	14.1	14.7	16.2	17.4	18.9	21.7	24.6
Corn, Field		6.5	7.1	7.7	8.5	8.9	9.4	9.9	10.7	11.4	12.2	12.7	13.2	13.6	15.4	16.8	18.3	20.6	23.0
Corn, Sweet	3.8	4.8	5.8	6.4	7.0	7.7	8.4	9.0	9.5	10.0	10.6	11.4	12.0	12.8	14.0				
Cotton	3.7	1	5.2		6.3	6.5	6.9	7.5	7.8	8.5	9.1	9.8	10.1	11.5	12.9	15.5	19.6		
Cucumber	2.6	3.4	4.3	4.9	5.6	6.1	6.6	7.1	7.5	7.9	8.4	9.0	9.6	10.1	10.2				
Egg plant	3.1	4.7	4.9	5.6	6.3	6.8	7.4	8.0	8.6	9.2	9.8	10.4	11.2	11.9	12.5	13.1	13.7	14.3	14.9
Endive	3.5	4.0	4.5	5.2	6.0	6.2	6.4	6.6	6.8	7.7	8.7	9.3	9.9	11.5	13.2	14.1	15.0	15.9	16.8
Fescue, Red	3.8				7.0	8.0	8.8	9.6	10.3	10.9	11.6	12.6	13.8	15.3	17.3	19.8	23.1		
A.V. (gr moist / kg air)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0
R.V. at T=25°C (77°F)	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100



#### Equilibrium moisture content of seeds

R.V. at T=25°C (77°F)	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
A.V. (gr moist / kg air)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0
Fescue, Tall		6.5	7.3	8.0	8.7	9.5	10.2	10.9	11.2	11.5	11.7	11.9	12.5	13.2	15.0	17.3			
Flax	3.3	4.4	4.9	5.2	5.6	5.8	6.1	6.3	6.8	7.3	7.9	8.6	9.3	10.0	11.4	13.9	15.2	18.3	21.4
Garden Cress	1.9	2.8	3.7	4.6	5.5	6.4	7.3	8.2	9.1	9.5	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0
Grass, Common Bent-		6.3	6.4	6.6	6.7	7.3	7.9	8.5	9.2	9.8	10.5	11.3	12.1	13.0	14.4	16.2	19.2		
Grass, Creeping Bent-		6.3			8.2			10.2		9.7		10.8	11.3	12.7	14.3	<b>16.4</b>			
Grass, Intermediate Rye-		7.1	7.8	8.4	9.1	9.8	10.5	11.0		9.4			11.9	12.9	13.9	16.2			
Grass, Italian Rye-		6.5	7.2	7.9	8.6	9.2	10.0	10.7		11.2	12.5	13.0	13.8	15.0	15.7	16.3			
Grass, Perennial Rye-	4.5	5.5	6.5	6.8	7.6	8.8	9.1	9.9	10.6	11.2	12.5	12.9	14.2	15.3	17.1	19.9	23.3		
Grass, Reed canary										11.4		12.0	12.5	13.5	14.7	15.7			
Grass, Smooth Meadow	5.9	6.2	6.5	6.8	7.5	8.3	9.0	9.7	10.5	11.2	12.0	12.8	13.5	14.6	16.1	18.1	21.3		
Groundnut	3.0	2.6	3.9	3.7	4.2	4.7	5.1	5.6	5.9	6.7	7.0	8.1	8.5	9.8	11.1	12.0	17.2	13.9	15.0
Lettuce	3.0	4.0	4.2	4.6	5.0	5.4	5.9	6.3	6.7	7.15	7.6	8.3	9.1	9.6					
Linseed	3.3	4.4	4.9	5.2	5.6	5.8	6.1	6.4	6.8	7.9	8.3	8.9	9.3	10.0	12.4	14.5	15.2		
Lupin, Yellow	4.2	5.2	6.2	7.0	7.8	8.4	9.1	9.8	10.5	22.2	11.7	12.5	13.4	14.5	16.7		>25		
Maize	6.2	6.4	7.9	8.6	9.3	10.0	10.7	11.3	11.9	12.5	13.1	13.8	14.6	15.5	16.5	18.6	20.7		
Maize, Shelled					8.3		9.8		11.2		12.9		14.0		15.6		19.6		23.8
Mustard	1.8	4.0	3.2	4.4	4.6	5.2	5.8	6.3	6.7	7.2	7.8	8.3	8.9	9.4					
Oats	5.6	7.2	7.6	8.0	8.4	8.7	9.9	10.2	11.2	11.7	12.5	13.3	14.3	15.3	16.8	18.6	22.3		24.1
Legumes	3.8	7.5	7.2	8.1	8.3	8.7	9.9	10.0	11.2	11.7	11.2	13.3	14.3	13.1	14.5	18.6	22.3		
Onion	4.6	5.7	6.8	7.4	8.0	8.5	9.0	9.5	10.0	10.6	11.2	11.9	12.6	13.4	13.6				
Onion, Welsh	3.4	4.2	5.1	6.0	6.9	7.7	8.8	9.4	10.3	10.9	11.8	12.6	13.4	14.0					
Opium poppy				4.4	4.9	5.4	5.9	6.3	6.9	7.4	8.0	8.7	9.5	10.3	11.7	13.7	17.0		
Parsley			5.7	6.0	6.4	7.1	7.9	8.0	8.2	9.0	9.9	10.5	11.1						
Parsnip	5.0	5.5	6.1	6.5	7.0	7.4	7.8	8.2	8.6	9.0	9.5	10.1	10.6	11.2					
Pea	5.4	6.1	7.3	7.8	8.6	9.4	10.3	11.1	11.9	12.7	13.5	14.2	15.0	15.9	17.1	19.0	22.0		
Pepper	2.8	3.6	4.5	5.2	6.0	6.6	7.2	7.8	8.3	8.7	9.2	9.8	10.4	11.0	12.0				18.6
Poppy-seed	2.9	3.4	3.9	4.4	4.9	5.4	5.9	6.3	6.9	7.4	8.0	8.7	9.5	10.3	11.7	13.7	17.0	17.8	
Pumpelly's Brome		6.6			9.0			11.5		11.0		12.5	13.1	13.7	16.1	18.4			
Purslane						8.6	9.6	10.7	11.9	12.6	13.3	13.5	13.8	1					
Radish	2.6	3.2	3.8	4.4	5.1	5.7	6.2	6.8	7.3	7.8	8.3	8.9	9.5	10.2					
Rapeseed	3.1	3.5	3.9	4.4	4.7	5.3	5.5	6.2	6.3	7.0	7.3	8.0	8.4	9.1	10.1	12.0			
Rice		5.9	7.6	8.2	8.6	9.6	10.2	10.7	11.3	11.9	12.8	13.3	13.8	14.6	15.8	16.8	18.4	20.8	
Rye		7.0	7.6	8.2	8.7	9.4	10.0	10.5	11.1	11.7	12.2	13.1	13.9	14.8	16.6	18.5	20.6	23.6	
Salad, Corn-					7.1	7.7	8.2	8.8	9.0	9.2	10.0	10.8							
Sorghum	4.4	6.4	7.3	7.9	8.6	9.2	9.9	10.5	11.0	11.5	12.0	13.0	14.2	15.2	15.8		18.8	20.3	21.9
Soybean	3.8	4.3	5.5	5.9	6.5	6.8	7.1	7.4	8.0	8.6	9.3	10.5	11.5	13.1	14.8	16.4	18.8		
Spinach	4.6	5.5	6.5	7.1	7.8	8.3	8.9	9.5	10.0	10.6	11.1	11.8	12.4	13.2	14.5				
Squash, Winter	3.0	3.6	4.3	4.9	5.6	6.2	6.8	7.4	7.9	8.4	9.0	9.6	10.2	10.8					22.5
Sugar beet	4.4	5.3	6.3	7.1	8.0	8.9	9.4	10.2	10.7	11.3	12.0	13.0	13.3	14.5	16.6	18.6	20.5	N	
Sunflower					5.1	5.6	6.0	6.5	7.0	7.5	8.0	8.7	9.3	10.0	11.5	13.5	15.0		
Tomato	3.2	4.1	5.0	5.6	6.3	6.9	7.5	7.8	8.3	8.7	9.2	10.1		11.1	12.0				
Turnip	2.6	3.3	4.0	4.6	5.1	5.5	5.9	6.3	6.7	7.0	7.4	7.9	8.5	9.0	10.0				
Watermelon	3.0	3.5	4.8	4.5	6.1	5.6	5.9	7.6	6.7	7.1	8.8	7.9	8.4	10.4	11.0				
Wheat	5.5	6.5	7.0	8.0	8.5	9.2	9.9	10.4	11.1	11.6	12.1	12.9	13.7	14.6	15.9	19.2	19.8	23.0	26.6
Wheat, Durum		6.6	7.2	7.8	8.5	9.1	9.5	10.0	10.5	11.0	11.5	12.4	13.2	14.1	15.4	18.0	19.3	22.9	
Wheat, Hard Red Spring		6.8	7.3	7.9	8.5	9.0	9.5	10.1	10.7	11.2	11.8	12.8	13.8	14.8	16.6	17.9	19.7	22.3	26.3
Wheat, White		6.7	7.3	7.9	8.6	9.0	9.4	9.9	10.5	11.2	11.8	12.9	13.9	15.0	16.1	18.5	19.7	23.0	25.0
Wheat, Winter Hard Red		6.4	7.1	7.8	8.5	9.3	9.9	10.5	11.1	11.8	12.5	13.1	13.8	14.6	16.1	17.9	19.7	22.3	25.6
Wheat, Winter Soft Red		6.3	7.0	7.7	8.6	9.3	9.9	10.6	11.0	11.4	11.9	12.8	13.8	14.6	16.1	17.9	19.7	22.6	22.0
A.V. (gr moist / kg air)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0
R.V. at T=25°C (77°F)	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100

#### Agratechniek b.v.

#### Seed names with translation

English	Latin	Nederlands	Deutsch	Français	Español	Italiano
Alfalfa	Medicago sativa	Luzerne	Luzerne	Luzerne	Alfalfa	Erba medica
Asparagus	Asparagus officinalis	Asperge	Spargel	Asperge	Espárrago	Asparago
Barley	Hordeum	Gerst	Gerste	Orge	Cebada	Orzo
Bean	Faba	Boon	Bohne	Haricot	Friiol	Fava
Bean Broad	Vicia faha	Boon Tuin	Bohne Acker-	Haricot	Haha	Fava
Been, French	Dhasaalus uulgaris	Boon, ruin	Bohne, Ackel-	Haricot vort	ludía	rava
Bean, French	Phaseolus vulgaris	Boon, shij	Bonne, Schnitt-		Juula Davata China	
Bean, Mung	Vigna radiata	Boon, Mung	Bonne, Mung-	Haricot mungo	Poroto Chino	Fagiolo Indiano Verde
Bean, Runner	Phaseolus coccineus	Boon, Pronk	Bohne, Feuer-	Haricot d'Espagne	Ayocote	Fagiolo Scarlatto
Bean, snap	Phaseolus vulgaris	Boon, prinsessen	Bohne, Garten-	Haricot vert	Judía verde	Fagiolino
Bean, snap	Phaseolus vulgaris	Boon, sperzie	Bohne, Garten-	Haricot vert	Judía verde	Fagiolino
Beet	Beta	Biet	Rübe, Runkel-	Betterave	Remolacha	Barbabietola
Beet, garden	Beta vulgaris	Biet, rode-	Rübe, Rote	Betterave potagère	Remolacha roja	Barbabietola rossa
Birdsfoot Trefoil	Lotus corniculatus	Klaver, Gewone rol-	Klee, Gewöhnlicher Horn-	Lotier corniculé	Lotus corniculatus	Ginestrino
Black salsify	Scorzonera hispanica	Schorseneer, Grote -	Schwarzwurzel, Garten	Scorsonère d'Espagne	Salsifí negro	Scorzonera di Spagna
Buckthorn	Rhamnus	Vuilboom	Kreuzdorn	Bourdaine	Arraclán	Rhamnus
Buckwheat	Fagopyrum	Boekweit	Buchweizen	Sarrasin	Alforfón	Grano saraceno
Cabhage	Brassica	Kool	Kohl	Chou	Repollo	Cavolo
Cabbage Chinasa	Brassica rana	Kool Chinese	Kohl China	Chou Chinois	Repollo Chino	Cavolo cinese
Caudage, chinese	Consistent	Deprike	Noni, china-	Danzika	Dimiente	Deperancing
Capsicum	Capsicum	Рарпка	Раргіка	Рарпка	Pimento	Peperoncino
Caraway	Carum carvi	Karwij	Echter Kümmel	Carvi	Alcaravea	Cumino dei prati
Carrot	Daucus carota	Peen	Möhre	Carotte	Zanahoria	Carota
Carrot	Daucus carota	Wortel	Mörhe	Carotte	Zanahoria	Carota
Celery	Apium graveolens	Selderij	Sellerie	Céleri	Apio	Sedano
Chicory	Cichorium intybus	Cichorei, Wilde	Gemeine Wegwarte	Chicorée sauvage	Achicoria común	Cicoria comune
Chicory	Cichorium intybus foliosum	Witlof	Chicorée	Chicorée amère	Achicoria	Cicoria witloof
Chive	Allium schoenoprasum L.	Bieslook	Schnittlauch	Ciboulette	Cebolleta	Erba cipollina
Clover, Alsike	Trifolium hybridum	Klaver, Basterd	Klee, Schweden-	Trèfle hybride	Alsike	Trifoglio ibrido
Clover, Crimson	Trifolium incarnatum	Klaver, Inkarnaat-	Klee Inkarnat-	Trèfle incarnat	Trébol encarnado	Trifoglio incarnato
Clover Red	Trifolium pratense	Klaver Rode	Klee Wiesen-	Trèfle des prés	Tréhol roio	Trifoglio dei prati
Clover, Reco	Trifolium birtum	Klaver	Klee	Tròflo	Trébel rojo	Chiede di gerefene
Clover, Rose	Trifelium fragifarum	Klaver Aardhai	Klee Fallson	Trèfle freisier	Trébal fraca	
Clover, Strawberry		Klaver, Aardbei-	Klee, Erdbeer-			Tritoglio a tragola
Clover, subterranean	Trifolium subterraneum	Klaver, Onderaardse	Klee, Bodenfrüchtiger	Trèfle souterrain	Trébol subterrâneo	Trifoglio sotterraneo
Clover, White	Trifolium repens	Klaver, Witte	Klee, Weiß-	Trèfle blanc	Trébol blanco	Trifoglio bianco
Clover, Yellow sweet	Melilotus officinalis	Klaver, Akkerhoning-	Klee, Gelber Stein-	Luzerne royale	Trébol de olor amarillo	Meliloto
Cocksfoot	Dactylis glomerata	Kropaar	Knäuelgras	Dactyle	Dáctilo	Dattile
Corn, field	Zea mays	Maïs, veld	Mais, Feld-	Maïs, champ	Maíz de campo	Mais, campo
Cotton	Gossypium	Katoen	Baumwolle	Coton	Algodón	Cotone
Cucumber	Cucumis	Komkommer	Gurke	Concombre	Pepino	Cetriolo
Dill	Anethum graveolens L.	Dille	Dill	Aneth	Eneldo	Aneto
Egg plant	Solanum melongena	Aubergine	Aubergine	Aubergine	Berenjena	Melanzana
Endive	Cichorium endivia I	Andiivie	Endivie	Chicorée scarole	Escarola	Scarola
Fescue Red	Festuca rubra	Zwenkaras Bood	Schwingel Bot-	Eétuque rouge	Eestuca roia	Festuca rossa
	Festues arundingess	Zwenkgras, Noou	Schwingel, Not		Fostuca roja	Festure erundingene
Flow	Linum usitatissimum	Viac	Elachos	Lin	Lino	
		vias	i lacifies		Lino	
Flax seed	Linum usitatissimum	Lijnzaad	Leinsamen	Lin, Graines de lin	Linaza	Semi di lino
Foxglove, Common	Digitalis purpurea	Vingerhoedskruid	Roter Fingerhut	Digitale pourpre	Digital	Digitale purpurea
Garden cress	Lepidium sativum L.	Tuinkers	Gartenkresse	Cresson alénois	Berro de huerta	Crescione
Grass, Common Bent-	Agrostis capillaris	Gras, Gewoon struis-	Gras, Rote Strauß-	Agrostis commun	Agrostis capillaris	Agrostide canina
Grass, Couch-	Elymus repens	Kweek	Kriech-Quecke	Chiendent officinal	Grama	Gramigna
Grass, Creeping Bent-	Agrostis stolonifera	Gras, Fiorin-	Gras, Weißes Strauß-	Agrostide stolonifère	Agrostis stolonifera	Agrostide stolonifera
Grass, Dallis	Paspalum	Paspalum	Paspalum	Paspalum	Paspalo	Panico Brasiliano
Grass, Italian Rye-	Lolium multiflorum	Gras, Italiaans raai-	Gras, Italienisches Rav-	Ray-grass d'Italie	Lolium multiflorum	Loiessa
Grass. Perennial Rve-	Lolium perenne	Gras. Engels raai-	Gras, Deutsches Weidel-	Rav-grass anglais	Ballica inglesa	Loietto perenne
Grass. Reed Canary	Phalaris arundinacea	Gras. Riet-	Gras Rohrglanz-	Baldingère faux-roseau	Hierba Cinta	Saggina spagnola
Grass Smooth Moodow	Pop protensis	Gras Veldbeamd	Gras Wiecon Picnon	Pâturin des prés		
	rua praterisis	Gras, Velubeennu-	Gras, wiesen Kispen-	Faturni des pres		rua pratense
Grass, Timothy-	Phieum pratense	Gras, Timotee	Gras, Wiesen Liesch-	Fieole des près	Phieum pratense	FIEO
Groundnut	Arachis hypogaea	Aardnoot	Erdnuss	Arachide	Cacahuete	Arachide
Lavender	Lavandula	Lavendel	Lavendel	Lavande	Lavanda	Lavanda
Legumes	Leguminosae	Peulvrucht	Hülsenfucht	Abelmoschus	Legumbres	Gombo
Lettuce, butterhead	Lactuca sativa	Sla, krop	Salat, Kopf	Laitue pommée	Lechuga	Lattuga
Lettuce, iceberg	Lactuca sativa	Sla, ijsberg	Salat, eisberg	Laitue pommée	Lechuga	Lattuga
English	Latin	Nederlands	Deutsch	Français	Español	Italiano

#### Agratechniek b.v.

#### Seed names with translation

English	Latin	Nederlands	Deutsch	Français	Español	Italiano
Lima Bean	Phaseolus lunatus	Boon, Lima	Bohne, Lima-	Haricot de Lima	Judía de Lima	Fagiolo di Lima
Linseed	Linum usitatissimum	Lijnzaad	Leinsamen	Lin, Graines de lin	Linaza	Semi di lino
Lupin	Lupinus	Lupine	Lupine	Lupin	Altramuz	Lupino
Lupin, Garden	Lupinus polyphyllus	Lupine, Vaste -	Lupine, Vielblättrige	Lupin des jardins	Lupino	Lupino da fiore
Lupin, Yellow	Lupinus luteus	Lupine, Gele -	Lupine, Gelbe-	Lupin jaune	Altramuz amarillo	Lupino giallo
Maize	Zea	Maïs	Mais	Maïs	Maíz	Mais
Marjoram	Origanum majorana	Majoraan	Majoran	Marjolaine	Mejorana	Maggiorana
Millet	Panicum miliaceum	Gierst	Hirse	Millet	Borona	Miglio
Millet	Panicum miliaceum	Gierst	Hirse	Millet	Mijo	Miglio
Mustard	Brassica juncea	Mosterd	Senf	Moutarde	Mostaza	Senape
Oats	Avena sativa	Haver	Hafer	Avoine	Avena	Avena
Oilseed	Papaver somniferum	Blauwmaanzaad	Mohn	Pavot	Adormidera	Papavero
Onion	Allium	Ui	Zwiebel	Oignon	Cebolla	Cipolla
Onion, green	Allium fistulosum	Ui, lente	Cipollotti	Oignon cébette	Cebolla de primavera	Cipolla, Gallese
Onion, spring	Allium fistulosum	Ui, bos	Cipollotti	Échalotte	Cebolleta	Cipolla, Gallese
Opium poppy	Papaver somniferum	Slaapbol	Schlafmohn	Pavot somnifère	Adormidera	Papavero da oppio
Parsley	Petroselinum crispum	Peterselie	Petersilie	Persil	Perejil	Prezzemolo
Parsnip	Pastinaca sativa	Pastinaak	Moorwurzel	Panais sativa	Chirivía	Pastinaca
Pea	Pisum sativum	Erwt	Erbse	Pois	Guisante	Pisello
Pea, Chick	Cicer arietinum	Erwt, Kikker-	Kichererbse	Pois chiches	Garbanzos	Cece
Pea. Sweet	Lathyrus odoratus	Erwt, Pronk-	Erbse. Duftende Platt-	Pois de senteur	Guisante de olor	Cicerchia odorosa
Pea, Sweet	Lathyrus odoratus	Welriekende lathyrus	Erbse, Duftende Platt-	Pois de senteur	Guisante de olor	Cicerchia odorosa
Peanut	Arachis hypogaea	Pinda	Aschantinuss	Cacahuète	Maní	Arachide
Pepper	Piper	Peper	Pfeffer	Poivre	Pimienta	Рере
Poppy-seed	Papaver somniferum	Blauwmaanzaad	Mohnsamen	Pavot somnifère	Semilla de amapola	Semi di papavero
Pumpelly's Brome	Bromus inermis	Kweekdravik	Wehrlose Trespe	Brome inerme	Bromus inermis	Bromo inerme
Purslane	Portulaca oleracea L.	Postelein	Portulak	Pourpier	Verdolaga	Porcellana
Radish	Raphanus sativus	Radiis	Radieschen	Radis	Rábano	Ravanello
Rapeseed	Brassica napus	Koolzaad	Raps	Colza	Colza	Semi di colza
Rhubarb	Rheum rhabarbarum	Rabarber	Rhabarber	Rhubarbe	Ruibarbo	Rabarbaro
Rice	Orvza sativa	Riist	Reis	Riz	Arroz	Riso
Rve	Secale cereale	Rogge	Roggen	Seigle	Centeno	Segale
Sage	Salvia officinalis	Salie	Salbei	Sauge	Salvia	Salvia
Sage. Scarlet	Salvia splendens	Salie. vuur	Salbei, Feuersalbei	Sauge rouge	Salvia escarlata	Sage, fire
Salad corn-	Valerianella locusta	Sla. veld	Feldsalat	Mâche	Canónigo	Dolcetta
Scarlet runner	Phaseolus coccineus	Boon, Pronk	Feuerbohne	Haricot d' Espagne	Judía pinta	Eagiolo Scarlatto
Scorzonera	Scorzonera	Schorseneer	Schwarzwurzel	Salsifis noir	Escorzonera	Scorzonera
Sesame	Sesamum inducum	Sesamzaad	Sesam	Graines de sésame	Sésamo	Sesamo
Sorghum	Sorghum	Sorgo	Hirse	Millet	Sorgo	Sorgo
Sorghum	Sorghum	Sorghum	Sorghumhirse	Sorgo	Sorgo	Sorghum
Sovhean	Glycine	Soiaboon	Sojabohne	Soia	Soia	Soia
Spinach	Spinacia oleracea	Spinazie	Spinat	Épinard	Espinaca	Spinaci
Squash, winter	Cucurbita	Pompoen, winter	Kürbis, winter	Courge d'hiver	Calabaza de invierno	Zucca, inverno
Sticky Heads	Paspalum dilatatum	Thrasva	Paspalum	paspalum	Paspalo	Paspalum
Sugar beet	Beta vulgaris I	Biet, Suiker-	Rübe Zucker-	Betterave à sucre	Remolacha azucarera	Barbabietola da zucchero
Sunflower	Helianthus annuus	Zonnebloem	Sonnenblume	Tournesol	Girasol	Girasole
Tomato	Solanum lycopersicum	Tomaat	Tomate	Tomate	Tomate	Pomodoro
Turnip	Brassica rapa	Stoppelknol	Rübe, Stoppel-	Navet	Nabo	Rapa da foraggio
Vetch, Fodder	Vicia villosa	Bonte wikke	Zottige Wicke	Vicia villosa	Vezo piloso	Veccia villosa
Watermelon	Citrullus	Watermeloen	Wassermelone	Pastèque	Sandía	Anguria
Wayfaring Tree	Viburnum lantana	Wollige sneeuwhal	Wolliger Schneehall	Viorne lantane	Viburnum lantana	Lantana. Lentaggine
Wheat	Triticum	Tarwe	Weizen	Froment	Trigo	Frumento
Witloof	Cichorium intyhus foliosum	Witlof	Chicorée	Chicorée amère	Achicoria	Cicoria witloof
Yellow melilot	Melilotus officinalis	Klaver, Citroeng honing-	Klee Gelber Stein-	Mélilot jaune	Trébol de olor amarillo	Meliloto
English	Latin	Nederlands	Deutsch	Français	Español	Italiano



Efficient drying of seed in boxes with processors for automatically drying to the desired moist content level. Stacking 3 to 7 boxes high. Using height gives maximum drying volume on minimum floor space; more drying capacity.



The openings in front of the air distribution system are on position of each box pallet. Extraction outdoor air from the back by an opening in the wall. Recycling indoor air when outdoor is too damp.



Pallet bottom closed by 9mm plywood.



Difference in thickness between plywood and hardwood plank.



Difference makes openings between box layers for escaping moisture on each layer.



Boxes are place in front and on top of each other.



A fan extracts outdoor or indoor air. Air will be heated or dried and distributed over the box levels.



Dry air extracts moisture from the product and moist air escapes per layer out of the product.





Example of installation for 2 rows of boxes, 5 boxes high. Heated by central heating on hot water radiator



Overview drying installation for 2 sections with central heating.



Outlet of moist air out of the product between the box levels.



Example drying box with double pallets: ventilation and transport. Box with plywood with coating.



Connection of tubes to radiator inside the air distribution installation.



Measuring T°+HR of out coming air which is related to the product.



Example of box from plywood with larger volume; different sizes are possible up to 2000 ltr.

### Agratechniek b.v. ABC software for box drying installations

DRYING INSTALLATIONS & EQUIPMENT



By programming the equilibrium moisture content of the air, the seed will be dried to the desired moisture content automatically.

For each type of drying installation, Agratechniek has developed unique ABC software. With this software, the equipment is controlled and the desired settings are managed to achieve the desired drying result. The regulation is specifically made for each installation.

On the left an example of a drying installation with 11 sections `stacked box drying' with central heating.

Per section information is visible about the statuses and the measured values.



Control of the heating system by the ABC processor. Three boilers are connected to each other by means of a cascade control. As a result, using one boiler, the minimum capacity becomes very low. And by using all boilers, the combined maximum capacity is high; A buffer tank ensures that the water temperature to the radiators is very stable. The number of active boilers and the capacity is automatically controlled by the ABC; Efficient and energy cost-effective.

Sensors monitor the water temperature at various points, as information and also to report when the temperature is too low.

By clicking on a section on the main page, the control for this section opens. You will see information on the measured values. The activity and status of the equipment is also visible; % control, color and possible movement.

The desired settings page is immediately opened by pressing on different areas.

All types of ABC software are very visual and informative. This makes the configurations understandable and easy to operate.



gratechniek b.v. ABC software for box drying installations

DRYING INSTALLATIONS & EQUIPMENT

#### Modular gas burners can also be used as a heating source. These are usually directly fired propane gas burners.



The gas burners can be turned on. Hereby the choice can be made to use one or two gas burners.

The temperature is less accurate with gas burners compared to a central heating with water. For that reason, the ABC control has additional settings to stabilize the control to the maximum and to quickly get (and keep) the temperature at the desired level.

With the additional settings, the temperature is increased in a controlled manner, the desired temperature is minimally exceeded at the start and the stable temperature is quickly obtained.

i			Sec Temp / F	ction 1 RH settings.		1:2		14-09-2014 13:19					
Choice: ( Load pro	Choice: drying / post-drying / off Drying Load preser nr. 1 Save as preset nr. 0 Settings same as preset												
			Drying	-	F	Post-dry	ing	Measurem					
		Min.	Max.	Desired	Min.	Max.	Desired						
Product	Τ°		32.0 C			32.0 C	25.0 C	16.0 C					
Duct $T^\circ$		15.0 C	33.0 C	21.0 C	15.0 C	33.0 C	21.0 C	20.0 C					
Product	RH						35 %	90 %					
Delta T	•			5.0 C				4.0 C					
Delta Al	н			3.0 gr			1.0 gr	1.4 gr					
Duct AF	H i	2.0 gr			5.0 gr			8.7 gr					
Hatch p	osition	0 %	100 %		0 %	100 %		100 %					
Flow per	r box			1000 M3			500 M3	17540 M <sup>3</sup>					
Maximur Waiting	m time   time re	oost-dryi start pos	ng st-drying	150 Min. 3:00 I	Runtime r	estart p	Remaining ost-drying	0 Min. <b>0:05</b>					
	+	o <b>^</b> o	<b>→</b>	+	<b>†</b>   •			], 🗿					

The minimum capacity of these burners is 35-40%. This can cause a problem with low heating and/or a low air volume; below the minimum capacity, the gas burner turns off.

Agratechniek therefore uses two gas burners with different capacities per drying section. For example, if 100 kW is desired, 40 and 60 kW are chosen. Start with the smallest burner at minimum capacity (14kW). When the capacity is 100%, the 2nd burner is added to minimum capacity. This results to a capacity range of 14 to 100 kW.

This process is automatically controlled by the ABC processor according to the required capacity.

i	'	Predrying s Heati	ection 6 ng	1:2		4-06-2012 14:15
Hea	ating settin Heating Gas bur Gas bur	igs on/off ner 1 standby ner 2 standby				
Hea P-b P-b I-tir I-tir Zor Off Ma: Ma:	ating settin and too hi and too lo ne too high ne too low ne no cont set (heat) k increase k decrease k output (h	gs (code 3) gh (heat) w (heat) n (heat) (heat) rolling (heating) control heating heating output heating)			10.0 C 8.0 C 300 sec 240 sec 0.8 C 0.0 C 25 %/min 60 %/min 100 %	
	+	∂⁺∂→	+	•		), 🔊

By clicking on 'Drying - post-drying settings' this page is opened immediately. This page also clearly shows the setting values and measured values.

Very useful is the possibility of using `preset numbers'; 33 menus with specific drying configurations can be stored and simply be called up again.

These visualization and possibilities are applied in all ABC programs for controlling different types of drying installations.



### Drying and storage boxes for seed



High drying box for coarse seeds and rough seeds on straw. Drying boxes for small seeds; 2/3 high (top) or half-high boxes (right side). Corner post and middle brace are mounted outside; this means no extra gaps inside of the box.

Drying boxes made out of water resistant board; several models and dimensions.





Corner post and brace inside of the box means extra gaps. Seeds will stick in these gaps. Extra cleaning work to avoid contamination.

Big surface will increase drying speed with enough volume. (up to 2m3 with 60cm seed layer).

Higher pallet will decrease the air resistance. In case of high airstream an optimal air distribution to all box layers.





Drying box with slatted base with fine screen on top.



Drying box with grid and fine screen on top. 100% breathable.



Drying box with perforated screen for coarse seeds (beans, maize, etc).



### Drying and storage boxes for seed



Boxes can be piled Pallets up; space saving.









With extra provision, pallet can be turn over by fork lift truck in a safe way.



Box cannot move between the pile. The pallet cannot be damaged. Smooth dosing of seed.



In areas with a high humidity level, drying with outside air is very limited. The drying process of seed with crop ('on straw') proceeds slowly and demands a lot of energy. Closed cells with a cooling-drying installation (heat pump) provide a solution and save a lot of energy. The cells are built around the drying installation.



Depending on the needs and use, the lay-out and measurements of the cells are determined: 1 or more row of boxes per cell or 1 large cell with drying on 2 sides, 3-4-5-6 boxes stacked high. Volumes up to 30 or 40 m<sup>3</sup> per row are possible.



A cooling block hangs within the cell, which suctions the air through a hatch from the outside to the inside. The suctioned air is cooled down through the unit to achieve the desired moisture content in the cell. Above the fan a heating battery is placed to heat up the air to the desired temperature per row. It reduces the RH and the air can absorb the humidity from the product. Excessive heat can be discharged to another section, another cell or externally. An external heating source can be used to create additional heating rapidly.

i	1	Se Temp / I	ction 1 RH settings.		12		925
Choice: drying / Load preser nr. Settings same a	post-dr	ying / of Drying	12 12	Si	eve as pr	reset nr.	0 Measurem
	Min.	Max.	Desired	Min.	Max.	Desired	
Product T *		340 C			34.0 C	26.0 C	15.0 C
Room T* 2	15.0 C	35.0 C		0.0 C	35.0 C		16.4 C
Product RH	10001803			100000		35 %	75 %
Delta T *			6.0 C				0.4 C
Delta AV	1.00		6.0 gr			10 gr	0.2 gr
Duct AH	10 gr			5.0 gr			8.8 gr
Hatch position	0%	100 %		0 %	50 %		0 %
Flow per box			1200 M3			600 M3	0 M <sup>a</sup>
Maximum time p Waiting time ren	start pos	ng it-drying	150 Min. 3:00 F	Runtime	restart p	Remaining ost-drying	0.05
4	010	+	+	<b>*</b> _ ·	•	1	a, a

The advanced ABC processor controls the whole installation and dries the seed to the desired moisture content; the most suitable (dry) air (outside or inside air) is suctioned. The air will be cooled down to achieve the desired Absolute Moisture Content (AH, in gr/kg of air) of the air, using condensation. Afterwards the air will be reheated so it is able to absorb more air. The air from the product will become drier than the outside air, and internal air is automatically used for the remaining drying process.



#### **Conditioned drying in drying rooms**



When the product is moist and/or the outside air is dry, outside air is aspirated (on the left). When the air in the cell becomes drier than outside, inside air is partially used (in the middle). When the outside air is too moist or the air from the product is dry, only inside air is used for the drying process (on the right).



Next to the cooling-drying units, hatches are placed to discharge humid air. They are connected to suction hatches; 100% outside air means 100% opened position (on the left), 50% recirculation produces 50% discharge (in the middle) and with complete recirculation the discharge hatches are closed (on the right).

In narrow cells or wide cooling-drying units, the outlet hatches are placed behind the inlet hatches.



The box width and height depend on the product. Low boxes for seed in bulk, high ones for plants with seeds.



Overhead doors facilitate optimal use of the cell capacity.



Low boxes for plants in little bags or seeds in cotton bags.



The lay-out and design of the cells with boxes are client-specific. We will advise you.

### Drying with dehumidified air





#### Dehumidification of air by adsorption

Air can be dried to a low moisture level by adsorption. Drying or dehumidifying by means of adsorption concerns the binding of moisture in the air to a moisture-adsorbing material such as silica gel.

#### **Description rotor**

The centre of an adsorption dehumidifier is the rotor or adsorption wheel. This part consists for 82% out of a chemical bound silica gel that can adsorb moisture out of the process air that passes through the rotor.

The structure of the rotor looks like a honeycomb pattern with a lot of small air channels. All these air channels make a big adsorption surface which takes care of the dehumidification of the air that passes the rotor; the silica gel adsorbs water from the air.





The same rotor can also release moisture during the regeneration process

The dryer is therefore divided in 2 levels. The rotor adsorbs moisture in the level for process air. The rotor turn in the level for the regeneration process where the rotor is being dried. After the regeneration process the rotor is ready to adsorb moisture again.



#### Regeneration of the rotor

The silica gel in the rotor cannot adsorb water unlimited. Nevertheless the adsorption and regeneration process is a continuing process. To make the adsorption process a continuing process the construction of the rotor is designed to adsorb water at 75 or 50% of the total surface of the wheel (level for process air). 25 or 50% (depending the T° of the regeneration air) of the rotor is used for regeneration process (drying the rotor).





Rotor with 75-25 configuration; regeneration by hot air (150°C) from gasburner ad 25% of the rotor surface.

Rotor with 50-50 configuration; regeneration by warm air (60-80°C) from hot water battery or condensor.

By rotating, each part of the rotor will adsorb water and will later be dried by regeneration. The regeneration section is isolated from the adsorption section. By blowing hot air through the regeneration section, the adsorbed water will be removed from the rotor. The moist regeneration air will be evacuated through air-channels to outdoors.





#### Drying with dehumidified air

Economically and modulating drying of air; The hybride principle with double heat pump



#### Hybrid air dryer with double heat pump

The hybrid air dryer is specially developed to create very dry air with an constant (low) temperature (20-15°C) of the process air. Process air is first being cooled, so water in the process air will condensate on the evaporator. After this, the process air at 100% HR will be dried to a low level by the Adsorption rotor. Because of high HR, the capacity of the adsorption rotor is at its maximum.

#### First and second heat pump

Energy from cooling and condensation of the process air will be provided by the first heat pump to the condenser and liquid cooler. Air for regeneration (drying of the rotor) will be heated by this condenser and liquid cooler. After passing the rotor the regeneration air is wet and warm. This air contains a lot of energy. By cooling the air and condensation of the water, the maximum of energy will be taken from the regeneration air. By this second heat pump, this energy will also being provided for regeneration. Therefore, no external extra heating is needed and all energy will be used; energy saving!

#### **Recycling of process air for regeneration**

The airflow for the process air is variable. When the airflow has reached its minimum and is still more than desired, the process air will return automatically to be used for regeneration. Again energy saving!!

#### Seed vault; Low moisture content AND low temperature

To reach dry and cold air (10°C with 30% HR or 15°C with 20% HR) for long storage of seed, the hybrid air dryer will be provided with an aftercooler; The dry process air will be cooled by a third evaporator to be cooled to the low temperature. Ideal for the different storage rooms and the seed vaults.







Hybrid air dryers can also be equipped with additional options; The example below is a hybrid air dryer with a double heat pump. The principle here is the extra pre-drying of the process air by cooling, which releases a lot of energy. The regeneration air is simultaneously reheated with this released energy. With a double heat pump, the warm and moist regeneration air is strongly cooled again. This releases a lot of energy. With this energy, the process air can be heated to a desired (higher) temperature after drying. In addition, hot water can also be created via a heat exchanger, which ensures that the temperature of the process air can be further increased in a drying area.

#### Explanation of the indicated numbers:

- 1. Adsorption rotor
- 2. Cooling block for pre-drying process air
- 3. Heat block for heating up the regeneration air; drying the rotor.
- 4. Cold block for obtaining extra energy to heat water.
- 5. Heat block for heating the process air to the desired temperature
- 6. Temperature of the water for extra heating of the air per drying section/place
- 7. Control to external condenser to remove excess heat
- 8. Status, type of operation and automatically started by the ABC processor.

As an example (below) a closed installation where only dried air is used to dry the seed. This installation is located in an environment with 40-45°C outside air with a very high moisture content. The dried process air is distributed via a section to the desired drying location. Moisture is absorbed after which the process air is returned to the hybrid air dryer. There is therefore a closed air circuit for the process air.

A heating radiator has also been installed per drying place, which is fed with warm water from the air dryer. Available energy/heat is used to heat the water via a heat exchanger.



- 1. Inlet dried process air to the drying plant
- 2. Return moist process air to the air dryer
- 3. Inlet outside air for regeneration (drying) of the rotor.
- 4. Exhaust moist regeneration air
- 5. External condenser for excess heat discharge
- A. Vertical distribution duct of dried process air to the (4) drying points
- B. Vertical exhaust duct for moist process air from the drying areas
- 1A. Horizontal duct for distribution of the dried process air over the 3 drying sections (c1 to c3)
- 2B. Horizontal duct for discharge of the moist process air from the 3 drying sections.



#### Central air dryer with ABC processor

The air drying process is an expensive business; this applies not only to condensation and adsorption dryers, but also to the hybrid dryers of energetic interest (combined condensation and adsorption drying). It is not economical to place an air dryer at every drying installation. Continuous drying does not take place at all installations, and dried air is not required constantly.

On the right: Central hybrid air dryer



Agratechniek has developed a principle at which a **central air dryer (1)** brings the dried air to where it is needed **(1A)**. Various drying installations **(4, 5)**, Cabinet dryers (static **(6)** and rotary **(7)**), conditioning cells **(2)**, drying tables **(3)** or packing machines **(8,9)** are connected to a central air duct **(1A)**. Thanks to the advanced ABC process the dried air is discharged automatically to where it is needed at that moment.





During the seed drying process, a lot of moisture can be discharged using heated up outside air. Unfortunately the conditions of the outside air are not always suitable to reach the desired equilibrium moisture content at the end. Especially now that more seed companies want to receive, store and package the seed with a lower moisture content. To be able to dry the seed quickly and successfully, dried air is needed in the last phase.

#### Example of drying/conditioning cell:

- A. Supply of dried air
- B. Aspiration of outside air
- C. Discharge of moist air
- D. Return of dry air from the cell (recycling)

This principle can be achieved for each type of dryer



From the central hybrid air dryer, air is distributed by an air duct to the various drying sections. Each section has a central shut-off valve that opens when a drying area near this section needs dried air.

At the section, the dried air enters a vertical duct. Here the air is distributed over the various drying areas.



i	Conduit Gén	d'air sec éral	1:2	1-01-2009 0:00
	24.9 C 67 % 13.1 gr			
	26.7 C 0 % 64 % 13.3 g 26.2 C 53 C En marche	24.1 C 16 % 2.9 gr C 81 % F B 80 m3/h	Section 1 0 % 1.3 24 % 1.2 62 % 1.1	20 Pe 22.3 Pa 0 % Section 2 0 % 23 0 % 22 0 % 21
<b>(</b>	∂⁺∂→		•	<b>e</b> , <b>b</b>

The desired Absolute Moisture Content (AH), moisture difference (delta-AH) air volume, temperature, minimum drying time and maximum drying time can be set per phase. When the desired moisture content (plus minimum drying time) is reached or when the maximum time is passed, the next phase is started. In the example, phase 4 is active.

All settings can be stored and saves as preset (menu). Specific settings can be loaded per drying location; here no 5. Each page provides extensive information about air conditions, air flow, valves and other measurements.

Information of the airflow going to the central air dryer and from the central air dryer to the sections and drying places.

A. 100% outdoor air is used, the indoor air intake is closed.
B. 9400m<sup>3</sup>/h dried air is moved from the air dryer to two drying sections

C. At section 1, a valve is open 81% to let in dried air. D. At drying point 1.1 the valve is opened enough to achieve the desired moisture content.

E. At box position 1.2 the remaining dried air is available.



### Agratechniek b.v. Hybrid air dryer for drying in closed cells





With a central hybrid air dryer, the seed can be dried optimally and in a fully controlled manner in a closed cell. The right amount of dried air can be blown in per individual cell or room. The desired moisture content in the cell is thus achieved. The desired moisture content is adjustable per cell and can (if desired) be reduced in 5 separate phases during the drying process.

The air dryer can draw in outside air or recirculate air from the cell (return air). When the Absolute moisture content (AH, g water per kg air) of the air in the cell is higher than the outside air, the dryer draws in air from outside. The moist air in the cell is discharged outside.

When the air in the cell is drier than the outside air, the air dryer draws in this drier air and dries this air further.



The ABC control controls the air dryer and the valve sections for the drying process. Dried air is continuously blown into the cell with the most moisture (provided that the desired moisture content has not yet been reached there). A cell can also be appointed for priority drying.

By blowing enough dried air into a cell, the moist air in the cell is refreshed within a few minutes. The dried air is drawn in by the air distribution system and blown through the boxes. This dry air quickly absorbs a lot of extra moisture. Due to the continuous supply of dried air, the AH of the air coming from the seed (with plant) and the air in the cell will decrease rapidly. Less dried air is then needed to absorb the moisture in this cell and gradually more air is blown to the next moist cell.

In this way, each cell is dried to the desired moisture content (of the drying phase) and the hybrid air dryer is used optimally.

### Agratechniek b.v. Hybrid air dryer for drying in closed cells





Volume boxes for seed with crop.

Dried air is blown into the cell (A). Fans of the air distribution system (v) draw in this dried air and then blow it through the product.

At the start of the drying process, a lot of moisture is released. This moist air is discharged outside at (B). When the product starts to give off less moisture, the air in the cell becomes drier than outside. The air exhaust to the outside (B) is closed. The air is now drawn back to the air dryer via (C). The air is dried again and presented to the cell again.

This drying process is carried out fully automatically by the ABC processor. The desired moisture content can be set per cell. Dried air is blown into each cell until the desired moisture content of the air is reached.



'Half sized' boxes to dry smaller amount of seed.



### **Conditioned seed vault**

The high valual parent and basic seeds must be stored under the right air-conditions and in well protected rooms. Therefore, those rooms (seed vaults) must be foreseen from both thermal- and fire-insulation. Either Agratechniek or your own supplier can make sure that the right seed vaults will be build. The seed vaults will meet the requirements, by using the right materials and components.



Example of a cell block with three drying cells (left) and three seed vaults (right).

For long-term storage of the seeds, dry air with a low temperature is required. Therefore, it is necessary that the room will be refreshed with dried air whilst keeping the temperature low. A hybrid air-dryer with an extra post-cooler is the best and most economical solution to provide the needed dried and cooled air. The hybrid air-dryer (condensation and adsorption) with post-cooler provides a low moisture content at a low temperature. For example 15 T°C/59F° with 20% RH or 10 T°C/50F° with 30% RH. To achieve this, the seed vault must be completely damp proof. Thanks to the ABC processor, the central air-dryer will take the dried and cooled air automatically to every room or installation where it is desired. By doing this, every room is kept under the right conditions. With that, the conditions for drying rooms can be different from the conditions of seed vaults. Controlled by the ABC-processor.



Cross section of a seed vault with air valves; control valves for amount of air and fire valves for permanent seal if there is smoke and heat development or fire.

Image above: A central hybrid air-dryer distributes the dried and cooled air to the different rooms (cells). In this way, every cell can be kept at a low moisture content (2-3 gram water/kg) and a low temperature; a condition of  $10 \text{ T}^{\circ}\text{C}$  and 30% RH is possible by that. Because this air-condition will always be drier than the environment, the air from the cell will be recirculated and again brought to the desired condition. This saves a lot of energy.

Image on the left: Air-channels and valves ensure that the dried and cooled air will be blown into the cell. A circulating fan distributes the air equally through the room. A refreshing fan can bring constantly (if required) fresh air in the cell. Because of slightly overpressure, the moist air will stay outside the cell.



### **Conditioned seed vault**



Details of a cell-ceiling, with air inlet valves and fire valves;

- On the middle-left, import of fresh air; (A) a fan will take care of the necessary refreshment with fresh air.
- In the middle, inlet of dried and cooled air (B). The controlling valve under the ceiling decide automatically the amount of supplied air till the desired air conditions. A circulating fan(C) distributes the air in the vault.

• On the right, outlet of the air because of overpressure (D). This controlling valve is connected to the inlet valve. At every in- and outlet, a fire valve (E) is adjusted. The ABC processor ensures that they will close automatically if there are any problems; detection of smoke and heat, but also with gasses and an external fire-alarm.



The red line marks the fireproof shell of the cell. If there is any smoke detected or fire mentioned, the ABC processor ensures that the fire valves will close automatically. If the valves are closed, all the inlet openings are completely closed and are part of the fireproof shell. Besides that, it is recommended to have an external sprinkler system.



One central air dryer can provide several cells and drying installations of dried and cooled air; also outside the closed cells.



For drying seed, different air conditions can be set.

#### Seed humidification in boxes



When the seeds are too dry during harvest, they are too delicate and will give less profit. An option is to increase the moisture content of the seeds. It is important that this is carried out correctly. Ensure the supplied moisture is absorbed well by the seeds, and the desired moisture content can be controlled.

The simplest humidification method is to press air, in the form of very fine mist, through the seeds using an (ultrasonic) humidifier. In this case the problem is that the water is not really absorbed by the air, but float through the air as drops of water. However small the drops might be. This is comparable to mist; you get wet because the drops of water fall down on you. This way, the seeds, mostly at the supply side, will also become wet on the outside. Only over time the seeds will absorb the moisture. This can be harmful for the seeds and leads to an irregular seed moisture content.

When you use the humidification equipment of Agratechniek, the moisture would be absorbed by the air. There will be no more drops of water in the air. The Absolute Moisture content (AH: absolute humidity, grams of water per kilogram of air) will then rise. The seed humidification process will take place inversely to to the drying process; the dry seed wants to be in equilibrium with the more humid air. The seeds absorb the moisture from the air without the seeds becoming humid.



Humidifier in closed cell with internal circulation.

Our humidification equipment enables correct control of the desired air AH. It increases the seed moisture content to the desired moisture content in a controlled manner. By relating the AH of the ingoing air to the AH of the outgoing air (Delta AH), the moisture content in the entire box will increase evenly. This prevents the supply side from becoming to humid in relation to the seeds where the air exits. Seeds that absorb moisture slowly (beans), will have a lower Delta AH than seeds that absorb moisture faster.

The humidification process is recommended in a closed space. In this case, the moisture content in the space can be brought to the AH value where the seeds can reach the desired equilibrium moisture content. You can opt for an installation with only humidification, or a combination including a seed drying option. Ventilation system with integrated humidification and drying option.



#### Seed humidification in boxes



Ventilation system with humidifier and drying option.

During the humidification process, the humidifier blows humid air to the air distribution system. At that system the humid air is blown through the seeds

Besides humidification, the same installation can also be used for seed drying. The ventilation system will be produced with a valve to suction the outside air and heating to heat up the air.

Ventilation system for humidification or drying.

The ventilation system can be also be produced with equipment to humidify the seeds directly.

All circulation air will be supplied with extra moisture.





Humidifier in closed cell circulation for individual boxes.

There are different options to utilize your existing boxes for humidification. This version is manufactured to client specifications.

On the left an example with steel boxes, which are aerated individually. The humid air is suctioned on the rear side and circulates through the seeds.

This process is also possible together with seed drying.



In addition to drying on the basis of the equilibrium moisture content of the air with the desired final moisture content of the seed, the regulation of the drying can also take place on the basis of weight.

This principle can be applied to any installation where individual boxes are dried. With each box (or drawers/trays) placed, provisions are made to determine the weight.

The drying process is then further controlled automatically with the ABC software.

•	Drawer 2.1	1:2	16-09-2021
1	Temp/PL/weight set	tinge	6:27
		.ungs.	
Enter weight			
Weight measure	urement unit		10ar
Empty box w	eight 0 (k)gr 5	Start box produc	ct RH 32 %
Full box weigh	nt 1369 (k)ari	End box product	RH 11 %
Full box ENDy	veight 1045 (k)gr		
Pay weighing	choice Full hey/erate weight	t by Imonouro N	OW/ 1 fill in full have END
Waiting time	weight measurement	by measure N	
watung ume	weight measurement		20 Sec
🗙 Measure	empty box weight NOW	X Measure fu	II box weight NOW
Weight measu	urement settings		
Phase Weight	Loss Ratio		100 %
Phase Weight	: Loss Margin		10 (k)gr
Preferred wei	ght reduction scheme		AH->Temp->Flow
Correction Al	I by weight control		0.5 gr/kg
Correction ter	np by weight control		0.5 C/kg
Correction flo	w by weight control		5 %/kg
Always start	at the set point of the phase	ses Start with t	he setpoints of the new
A 4			Kala (a)

See example above:

The initial weight of the product is determined (1369x10 gr) and the initial moisture content is measured (32%). By entering the desired final moisture content (11%), the final weight is calculated 10450gr). The desired result is achieved with different settings.

**\_\_\_**\_

The net weight of the product can be determined as follows:

- Default box or drawer; empty weight is set at 0 (k)gr.
- Weight of empty box or container is determined and saved
- Manual entry of weight as indicated on the specific box or container



#### Drying by weight



Drying takes place in 5 stages. The number of measurements can be entered for each phase. During a measurement, the drying is stopped for a while in order to determine the weight accurately. In this example 30x (and 20x in phase 5). The value of the last measurement is displayed (13200gr). The desired weight at the next measurement is calculated (12950gr). The final weight is also stated (10450gr).

With treated seed, the amount of moisture that has been applied and that has to be removed again can also be adjusted. Then the drying ends when the initial moisture content is reached. Any added substances are taken into account during this process.

The moisture content (AH), temperature and air volume are automatically adjusted with each weighing in order to achieve the desired drying curve. The order of these can be set.

This principle can be applied to the following drying installations;



Seperate box drying



Also for the US type steel containers



Closed and open drawer dryers



Closed box dryers



Drying of primed, rinsed, coated, crusted and pelleted seed.

But of course also for intensive or fluid drying installations.



### Individual box dryer



Drying each box individually to the desired moisture content of the seed.



Example installation without boxes



Installation partly filled with boxes



Boxes placed in scaffolding in front of drying installation. Box can be placed or taken one's ready.



Extracted air heated and or dehydrated passes through each box individually.



Drying of an individually box starts when placed in scaffolding and stops automatically when the seed is dry.



### Individual box dryer



Measuring air out of seed per box to control.



LED-lamps for indication status of drying.



Example individual box drying with dehydrated air.

- A. Box with seed
- B. Inlet pallet
- C. High pressure fan per box
- D. Radiator heater with warm water



Extra option: temperature per box individually

- E. Valve for inlet outside air
- F. Air-duct and hatch for inlet dehydrated air
- G. Valve for inlet inside air (recycling).

#### Process:

The box is being placed, the fan will start automatically. The fan will speed up till the desired airflow as set for this box has been reached. The drying starts by extracting outside air. When seed starts to dry and outside air is not dry enough, dehydrated air will automatically mix with the outside air till the desired AH as programmed. When air out of the seed becomes dryer than outside air, automatically dry inside air will be extracted. The drying will continue till the air out of the seed has reached the AH as goes with the equilibrium moist content of the seed. At that moment, the slide will slowly close. When closed the seed in this box is dry.



#### ABC software for individual box dryers

1

3.8 g

1.3 ○ 26.3 C ○ 4.5 gr ○

1.2 23.6 C 6.0 gr

1.1 ○ 25.5 C ○ 6.3 gr ○

**^**i

1

3.7 g

3.3 ○ 25.1 C ○ 6.8 gr ○

22.7 C

6.2 gr

3.1 ○ 23.0 C ○ 6.2 gr ●

2.3 24.3 C 5.6 gr

i.4 gr

25.5 C

5.2 gr

000

1

SMS

4.3 ○ 25.2 C ○ 6.5 gr ○

25.8 C

6.7 gr

4.1 0 25.3 C 0 6.4 gr 0 6.4 g

5.3 25.0 C 6.9 gr

000

22.0 C

22.3 C

6.6 gr

On the right, an example of ABC software for an installation whereat every box can be dried individually is shown. The installation exists of five sections for every three boxes. An icon for a box, mentioning air, absolute humidity and temperature from the product, is shown.

For optimal drying, the sucked in fresh air will be mixed with dried air. Per section, one air valve, to bring in the right amount of dried air, is installed. Black means closed, green means open.

Per box an indication of the drying status; orange (drying), blue (post-drying) and white (finished).



By pressing the chosen icon, detailed information of the specific box will be opened.

✓

22-01-2019

12:37

2

<mark>26.0</mark>C 11.8%

2.5 gr

28 %

Enable dryer

- Schematic drawing of the place for a box, with installed equipment.
- Measuring- and controlling values of the ingoing air and the air from the product.
   Settings per individual box; per phase of the desired humidity of the air, temperature, minimum and maximum drying time.

To simplify the use of the installation, the ABC processor has got a function at which pre-sets (menus) can be set in advance.

These menus are tailor-made per installation, each using specific software.

Every composed menu will be saved under a unique number.

Every place for a box can now easily called and activate the desired menu (which belongs to that seeds variety).

Thus, the desired values can be set per seed type.

	<i>i</i>		Fluid mer Genera	านร ป			22-01-2019 12:37
	Menu Sauc monu in	≠ 4 mr 0					
	Save menu in	· · · · ·					
	AH	dA	Fan	Temp	Min T	Max T	
	Phase 19.5 gr	5.0 gr	100 %	25.0 C	10 Min.	30 Min.	
	Phase 28.5 gr	4.0 gr	80 %	20.0 C	10 Min.	120 Min.	
	Phase 37.5 gr	3.0 gr	70 %	18.0 C	90 Min.	120 Min.	
	Phase 46.5 gr	2.0 gr	60 %	16.0 C	10 Min.	120 Min.	
	Phase 55.5 gr	0.5 gr	40 %	15.0 C	10 Min.	120 Min.	
		<b>1</b> -					
1		r _ r					



#### ABC software for individual box dryers



Overview of the operating screen in the ABC Processor.

This shows a drying installation of 8 sections with 4 box places each. The operation is user-friendly; clicking the top frame of a section opens the section's main page.

A signal column indicates the drying status.

Here you'll find a cross-section giving a clear informative view of the process.

With this installation, inside or outside air is drawn in through the roof (no dried air). The air is heated by a hot water radiator. This temperature is equal for all box places in the section.

Various general settings for this section can be made on underlying setup pages.

By clicking on the drying place in the overview or in the cross section, the page with the settings for the specific drying place is opened.





This page shows all the measured values that are important when drying the seed in this box. Drying takes place in 5 phases. For each phase, the desired moisture content of the air (AH) coming from the seed and how dry the air should be in relation to the desired moisture content (dAH) can be set. In addition, the fan capacity and temperature can be set too. But also further settings of the desired minimum and maximum drying time. The last column shows how long the drying process took in that phase and how long the current phase is active.



When you are looking for ways to use your industrial spaces as efficiently as possible, it is often a good option to save space in drying installations. Furthermore, it is important to dry the seeds in every box well using sufficient air. And it is probable you would want to keep using the existing drying boxes.

Agratechniek has the possibility to meet all these needs;

- The boxes can be placed 3-4-5 stacked on top of each other in a drying installation.
- Below every box there would be a plenum, which blows air through the box with the help of 1 or 2 small high-pressure fans. This ensures sufficient air is blown through every box.
- The drying installation is manufactured to client specifications, i.e. adjusted to the measurements of your own boxes. And you can continue to use your own boxes.



In an existing or new hall, the height can be maximized with the individual drying installation. The height of the box quantity can be adjusted per row.



In a building with a surface of ca. 10x10 m and 6 m high, this option would make it possible to dry 40 boxes individually. The boxes are placed on top of each other in stacks of 5, and there is enough space for a forklift; 80% better use of your industrial space.



### Efficient and economical drying

With another set-up and a sidewall of 5 meters high, it is possible to dry at least 160 boxes at the same time, in a space of ca. 30 x 13.50 meters.



At the sidewall, the dry air is suctioned from the rear side. When there is a central set-up, the air is suctioned through a central shaft from the headwall.



Every box is equipped with 2 high-pressure radial fans. Thanks to the great efficiency of these fans, 30 boxes can be dried at the same time with 10 kW power. The air quantity would then be 60,000 m<sup>3</sup>/h at 300 Pa.

The air flows more difficult through a full box than through a half-full box. The same can be said for a humid box and a box with fine seeds. This can have large consequences for a standard drying installation with 1 fan. Almost no air will flow through a full box with moist and fine seeds, when it is lined up with boxes full of dryer and/or coarser seeds. And this is especially the case when there are half-full boxes in between those boxes. As every box in this particular drying installation has its own fans, every box will be dryed individually and

As every box in this particular drying installation has its own fans, every box will be dryed individually and effortlessly. Other boxes no longer have any impact. Every box can be installed when desirable at that moment.

The installation will be customized to your desires. We take into account the size of your boxes and the available height, the routing within your company and possible expansion in the future.

When the drying process takes place with 'double boxes' (dryer and humid), the installation will be adjusted as needed. Boxes will be restacked more efficiently as the top drying box can be placed directly into the empty place below or above.





### **Conditioned box dryer**

With the conditioned box drying installation the seed in the boxes can be dried to the desired moisture content. This can be freshly harvested seed, or seed that needs to be brought to a lower moisture content before shipping. With this conditioned drying installation, a small number of boxes can be dried individually. The installation can be manufactured according to your wishes and according to your specifications.



The conditioned box dryer is a closed installation with which the seed is dried to the desired moisture content at the desired air condition. This by using dried and cooled air. The boxes are placed separatedly from each other in an air distribution system. Which ensures that the air is sucked through the seed. The air distribution system is located in a closed casing so that the seed can be dried regardless of the outside conditions.

The box dryer is adapted to the size and design of the drying boxes. The box dryer is assembled according to your wishes; the number of sections and the number of boxes per section.

Dried air is added per section. This air is cooled or heated to the desired temperature. The equipment installed for this purpose is selected on the basis of the amount of seed, the moisture content and the desired drying speed.



### **Conditioned box dryer**

At the top, the air is brought to the desired moisture content and temperature. This ensures that the seed is always dried at the desired air conditions. The design of the air treatment installation depends on the required air circulation, the amount of moisture that must be removed and the temperature at which the drying needs to take place.



- The box dryer can be controlled by the ABC processor.
- The drying control can be carried out individually per section or per box.
- The installation is controlled per section, the seed dries in all box to the same moisture content.
- The inlet of outside air and dried air can only be done per section.

A high-pressure fan has been installed for each box. The air volume can thus be configured per box to match the quantity and type of the seed.

With the conditioned box dryer the air is sucked through the seed from the top to the bottom. The air is blown upwards at the rear and sucked in through the top at the front.



The picture above shows an option to remove humid air to the outside and to draw in drier (outside) air. In the case of moist seed, the drying time is thus greatly reduced. When the air from the seed becomes drier than the outside air, this air will automatically be used in the drying process.







#### Drying soaked seeds and pellets fluid in boxes

Drying installation for fluid drying of batches (soaked) seed and pellets in special drying boxes. The installation consist of drying sections and a central hybrid air-dryer by condensation and adsorption.



The box will be placed into the drying section. Each box place is provided with a fan. Dry air will be pushed through every individual box to make the product fluid and to dry homogeneous.

The outlet for each box place has a T°+HR sensor to measure outcoming moist content. When this air is damp, it will be blown to outside. When this air is dry, it will be recycled.





High-pressure fan with flow sensor for each box place.



Outlet with T°+HR sensor to control the process.



### Fluid drying in boxes



Box for wet seed is provided with cover to avoid blowing out of the seed.



Seed pellets (up to 4 milion per box) drying like little volcano's; fast but with care.



Wet seed, completely fluid.



Overview of the operating screen of a drying instal-

As an option each box place will be provided with a hot water radiator. Per phase the desired T° can be programmed individually; drying can start with high temperature because of all the moisture to be dehydrated.



Process to be programmed and controlled by a control panel with touchscreen and ABC software. lation with 3 sections containing 5 box places each.



Information of the airflow going to the central air dryer and from the central air dryer to the sections and drying places.



### Intensive or fluid drying in boxes

Seed pellets or soaked seeds are dried per box individually



Example of installation for drying of 100.000.000 seed pellets per hour.

The product is dried in phases according to a set menu for each individual box. The desired quantity, temperature and moisture content of the air programmed per phase. Per box the desired moisture content of the product will be reached.



Start drying with 100% outside air. The air will be heated and squeezed through the product. The warm air adsorbs moisture and is dispatched to outside.

Airflow per box: Inlet outside air Heated air wet air



### Intensive or fluid drying in boxes



When the air from the product is drier than the outside air, this dry air is recirculated. The last moisture from the product will be adsorbed by the dehumidified air.

Airflow per box: inlet dehumidified air Heated air recirculated air



For small quantities of treated seed (e.g. rinsed, pelleted) and fruit seeds, fast and even drying is usually of great importance. Preventing damage during drying (turning around) is also important.



Agratechniek offers the solution for small batches (2-10 kg) to achieve optimal drying.

The installation for intensive and fluid drying can also be designed to dry the seed in trays. 6 trays are placed on a pallet (size equal to the drying boxes).

The installation is now equipped with 3 small highpressure fans. Each fan with enough capacity to dry seed in 2 trays fluidly.

In order to automatically regulate the control of the fans, the presence of a tray is detected.

The detection is passed on to the ABC processor, which adjusts the fan control accordingly:

- With 2 trays, 100% of the set air volume is blown through the trays.
- With 1 tray this is reduced to 50%
- If there is no tray present, the fan will remain off.



In the ABC processor the control of the fans is clearly visualized per pallet with trays. There can be no misunderstanding about the presence of a tray; orange colored. Information is also visible about the air conditions of the incoming and outgoing air and where this air comes from.

## Agratechniek b.v. Fluid drying of fruit seeds and small amounts of treated seed



Above, the detection sensors are clearly visible. An empty spot is so clearly signaled. It is also detected when a container without a lid is placed on the pallet. The ABC processor will then give a warning and the drying will not start.



Of course it is also important that the drying area is closed when one of the two trays is not in place. There's a closing solution for that. The presence is also signaled by the ABC processor. Again a warning will appear and drying will not start.

This installation can also be used for larger quantities of seed in boxes.

Cross section and information about section 2 as visible in the ABC Processor.

- Air conditions of incoming outside air and outside air mixed with dried air,
- Water temperature
- Control of the basic heating
- Controlling the heating per section
- Temperature of the incoming air

The heating of the process air takes place in two phases;

- Warming up to the base temperature for all drying areas
- Extra heating to the specific temperature per drying place (fine tuning)

Because of this the required further heating is limited when fine tuning the separate drying areas, the control is refined and the temperature is very accurate.

Also, it is easier to use water with a low temperature.





#### **Open drawer dryer**

#### Drying – ventilation units for drawers



Drawers with gauze bottom



Air-inlet and air guidance per drawer



Easy placing drawer in the dryer



Air in- and outlet per drawer individually





#### **Open drawer dryer**

Easy handling



Fan for extracting conditioned air to blow through the seed



Air-inlet opens when drawer is being placed

Extracting unit including heater and valves







Fan with 5 speed or 0-100% controller



Controlling of heating by modulating thermostat and fan-speed control



### **Conditioned tray dryer**

In plant breeding, but also flowers seeds, the seed volumes are relatively small. However, these delicate and precious seeds must be treated very carefully. In this conditioned drying installation, small quantities of seeds are dried in trays, under the correct air conditions. The installation can be assembled to your needs and specifications.



The conditioned drawer or tray dryer is a closed installation. With this installation the seed is dried at the desired air temperature to the desired moisture content. This by using dried and cooled air. The trays or drawers are placed in an air distribution system. Which ensures that the air is blown or sucked through the seed. The air distribution system is located in a closed casing so that the seed can be dried regardless of the outside conditions.



- The drawer dryer can be controlled by the ABC processor.
- The drying control can be carried out individually per section or per drawer.
- The installation is controlled per section, the seed dries in all drawer to the same moisture content.
- The inlet of outside air and dried air can only be done per section.



The air can either be blown or sucked through the seed. The choice depends on the specific weight and the amount of seed. With a suction system, the light seed will always remain in the tray and will not be blown away. Dried air is added per section. This air is cooled or heated to the desired temperature.



On the right a suction system: In this version the air is sucked through the seed from top to bottom through each tray or drawer. The air is then lifted upwards at the rear and sucked in again at the front through the top. On the left a blowing system: In this version the air is being sucked in at the rear. And is then blown through the seed from bottom to top via a lockable opening. The air is sucked back to the rear through the top.



The air is brought to the desired moisture content and temperature at the top of the installation. This ensures that the seed is always dried at the desired air condition. The design of the air treatment installation depends on the required air circulation, the amount of moisture to be drained and the temperature at which there should be dried.



It is desirable to aerate and dry seed and pellets quickly. Therefore, small amounts can be collected in the bins and can be brought quickly to the drying installation. Agratechniek offers the possibility to ventilate immediately and dry thereafter, either with or without dried air; A drying installation with mobile aerating bins.

Together with these mobile aerating bins suits a drying installation which brings the product, through drying it with heated and if required also dried air, automatically to the desired moisture content.



Overview of the drying installation with mobile aerating bins and a central air-dryer.

The aerating bins can be delivered in various dimensions. Depending on the use, the bottom of the bin will either be foreseen of a perforated plate or an open grill. Regardless of the use will the bottom of the bins be foreseen with a stainless steel fine mesh. When preferred, the bin can be closed with a ventilated cover.







Bin 1500x1200 mmBin 1000x1000mmBin 500x500mmSome examples of the aerating bins in various dimensions. It is possible to make other dimensions



The aerating bin is brought to a drying installation and placed under the hood.



### Mobile aeration and drying



An aerating bin is foreseen from either one or two fans.



When finished drying, the bin can easily be cleared.

Every aerating bin is foreseen of a small high pressure fan. This fan has got the possibility to either have a manual controlling or an automatic controlling.;

- To aerate immediately, the aerating bin can be attached to the electric current (230V). The amount of air can • be adjusted by a turn button 0-100%.
- After that, the aerating bin can be attached to the drying installation. The voltage supply and the controlling . will take place by the central switchboard, together with the ABC drying processor. The product will be dried automatically.



The air will be blown from below the product. At the bottom of the bin, the air will be sucked in through an opening at the back of the bin.

Image on the right: The hood has got a window for inspection. This window can be opened if required



This opening at the back of the aerating bin is connected to the air outlet of the drying installation. This outlet is foreseen of a heater. The process air will be brought to the desired temperature in this heater (C). Through channels and slides, fresh air (A) and/or dried air (B) will be sucked in automatically. Through the hood, moist air will be drained (D). Dry air can be recycled and used again (E).



Drying of seed per drum individually is possible. The seed in a drum will automatically being dried to the desired equilibrium moisture content.





- - more damp than outside, this will be dispatched.
- (B) central airduct for inlet outside air
  - Starting with heated outside air a large quantity of water is drained.
  - When required, dehumidified air will be added to a drumunit to continue optimal drying.

**(C)** Central inlet for dehumidified air

- Dehumidified air will enter a • drum dryer when drier air is required.
- When air out of the drum is drier than outside, this will be recirculated.
- Drying continues with dehydrated air.







Slide inside for extracting outside or recycled air. Optional with dehumidified air.

Outside air is warmed up to the desired temperature to absorb moisture. Outside air and dehumidified air can be mixed to decrease AH and increase drying capacity.

When air out of the drum is more damp than outside, it will be dispatched outside (middle).

When air from the drum is drier than outside, this is recirculated and mixed with dehumidified air (left).

Final moisture from the product will be drained by dehumidified air.



Valve for dispatching wet air to outside (middle) and valve to recirculate dry air (left). In the back a valve to bring dehumidified air to mix with outside air or recirculated air when required.



### Economically drying of fruit seeds

Important when drying fruit seeds is that the seeds will not stick to each other. Therefore, it is wise to let the seeds move whilst drying. By doing this, you will prevent double seeds. A drum dryer is extremely suitable for this; either loose seeds or seeds in small bags will - because of the rotation of the drum dryer - keep moving whilst there is drying air blown along the seeds. The moving prevents that the seeds will stick to each other.





Cross section of a drum dryer

Each drum dryer has got an own fan so that there can be a desired amount of air set per drum.

The dryer can work either with or without heater.

The dryer is mobile and only requires a 230V or 400V connection.

Example of a mobile drum dryer for two drums.

When the seeds are dry on the outside, they will not stick to each other anymore. Then it is not necessary anymore that the seeds stay in the drum. They can continue drying static. A very economical way of drying is by some open or closed drawer dryer.



Seeds can be collected in drawers



Drawers with fine stainless steel mesh for ventilation



### Economically drying of fruit seeds



On the left, the open drawer dryer. This can be placed in a conditioned room. Air from this room will get sucked through the seeds. In this way, the seeds will be dried optimally at the right temperature and moisture content.

On the right, the conditioned closed drawer dryer. The front is foreseen of a rolling shutter. The drawer dryer can be placed at any desired (working) place.

The drawers have got a dimension of 400x800mm or 400x400mm. Other dimensions are possible.





Left: by opening the rolling shutter, the complete front will get opened and the drawers can be placed.

Normally, the conditioned drawer dryer has got 6 drawers.

When placing a drawer, the drawer will be automatically aerated.

Right: air is being sucked through the seeds per drawer. The air is blown to the conditioning unit at the top. There, the air will be dried and brought to the right temperature.



## Agratechniek b.v.

#### DRYING INSTALLATIONS & EQUIPMENT