



Use of Documents to Manage the Process within the Brewery

Craft Brewer Course

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Purpose: to answer the questions

- Why do we need to have a system of documents?
- Which types of documents do we need?
- Which purpose does the individual document serve?

Content

Documents:

- Recipe / Bill of Material
- Process Description
- Specification

Traceability

Quality and documents:

- Sample Plans
- Analysis

Recipe – Process Description – Specification

Recipe / Bill of Material (BoM):

- List of all ingredients with amounts
- No instructions in how to make the product

Process Description:

- A guide on how to produce a specific amount of a specific product on a specific plant

Specification:

- Limits specified by the brewery for which values of analysis will be accepted for each parameter

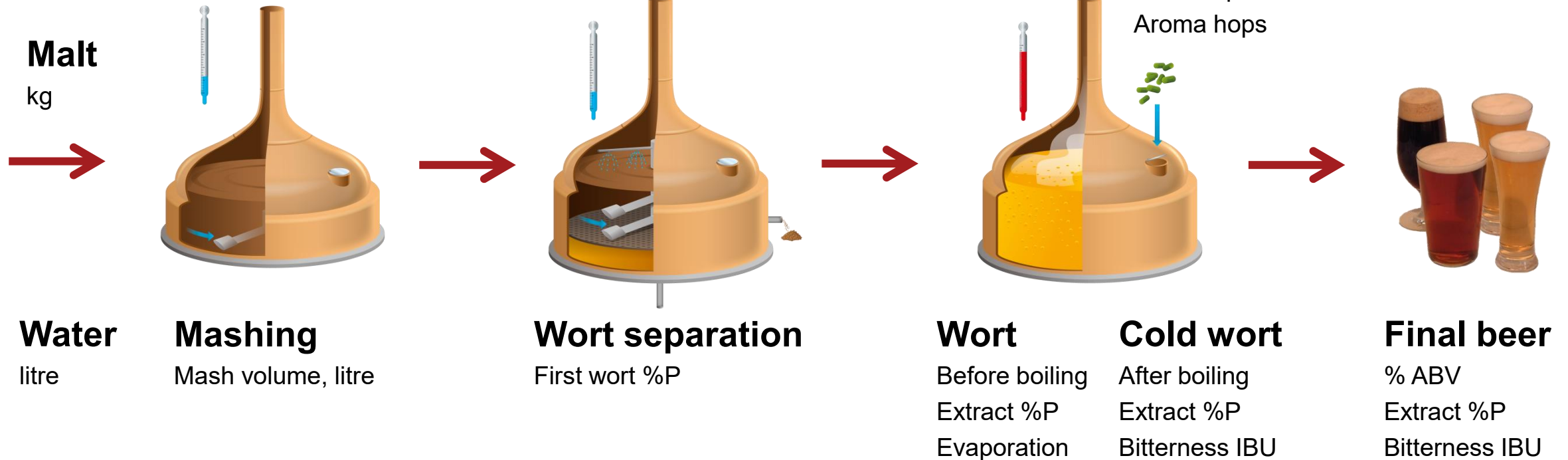


Recipe / Bill of Material (BoM)

List of ingredients with types and amounts for:

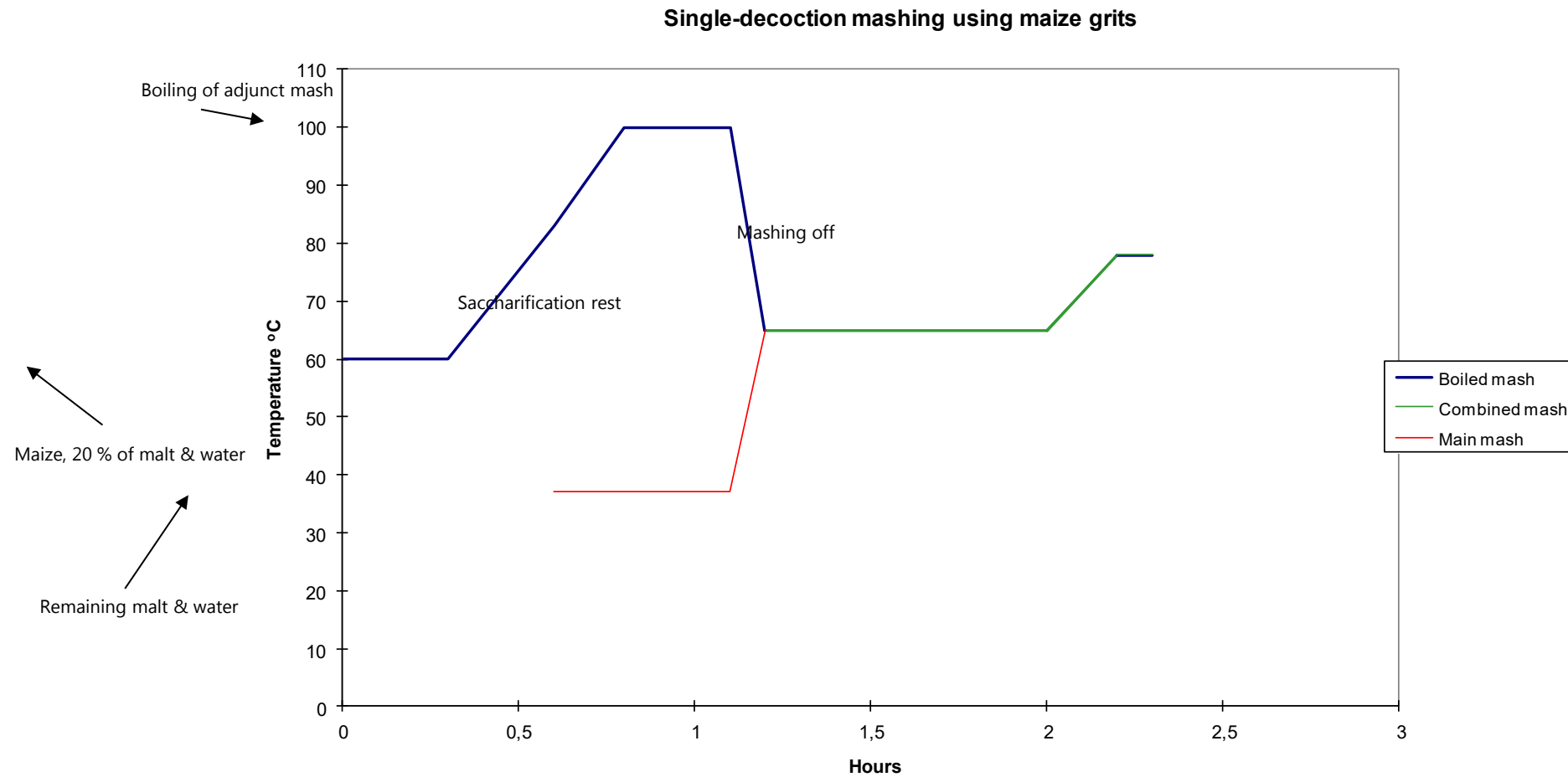
- Malt
- Adjuncts in mashing, in wort kettle and as priming
- Bitter- and aroma hops
- Water for mashing-in and sparging
- Salts, acids, colours, etc. in the brewhouse
- Colourings, preservatives, spices, etc. in filtration

Recipe Formulation



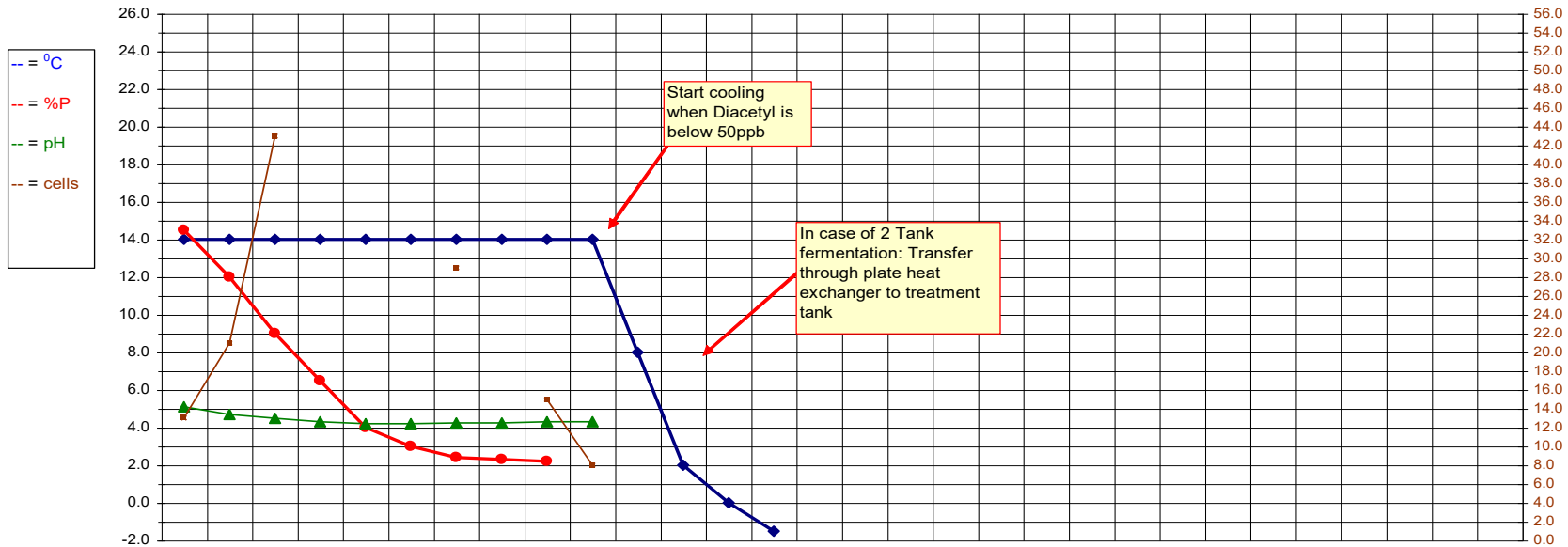
Examples of Process Descriptions

Example of Mashing Diagram



Example of Fermentation Chart

Fermentation/Maturation Record														
Beer	Brew No.	Tank No.	Tank Vol. hl (A)	Aeration DO ppm	Yeast Pitching					Pitching control hl (J)	Yeast Cropping			
					type	gen	cells, 10 ⁶ /ml (B)	% viabil. (C)	target pitching vol. hl (D)		rate, 10 ⁶ /ml (E)	cells, 10 ⁶ /ml (F)	vol. hl (G)	growth (H)
CB	5-9	5	2720	11.0	252	4	1430	99	25.0	13.0	25.0	1560	55	2.40



Day	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	27	28	29	30	
Date	23-Jun	24-Jun	25-Jun	26-Jun	27-Jun	28-Jun	29-Jun	30-Jun	01-Jul	02-Jul	03-Jul	04-Jul	05-Jul	06-Jul	07-Jul	08-Jul	09-Jul	10-Jul	11-Jul	12-Jul	13-Jul	14-Jul	15-Jul	16-Jul	17-Jul	18-Jul	19-Jul	20-Jul	21-Jul	22-Jul	
Temperature, °C	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	8.0	2.0	0.0	-1.5																	
% Plato	14.50	12.00	9.00	6.50	4.00	3.00	2.40	2.30	2.20																						
pH	5.10	4.70	4.50	4.30	4.20	4.20	4.25	4.25	4.30	4.30																					
Operation								y	c/d*	c/d*		d																			
Yeast Count, 10 ⁶ /ml	13.0	21.0	43.0				29.0	15.0	8.0																						
Diacetyl, ppb							142	96	59	36																					

Day Zero is calculated from "Pitched volume".
 $Yeast\ Count = (J \times B \times C) / (A \times 100)$

Comments: d* = draining day chosen depending on yeast sedimentation behaviour (i.e. at 4°C usually typical). Must be continued periodically until Tank is emptied.

Example of Work Instructions

Bilag 3 : Instruks til nedkørelse af øl på TTK 7-10

Start med at forspænde tankene med CO₂, ved at forbinde CO₂ ventilen på den lille flow plade med tilgangen på ttk'en



Åben nu roligt alle håndventilerne.

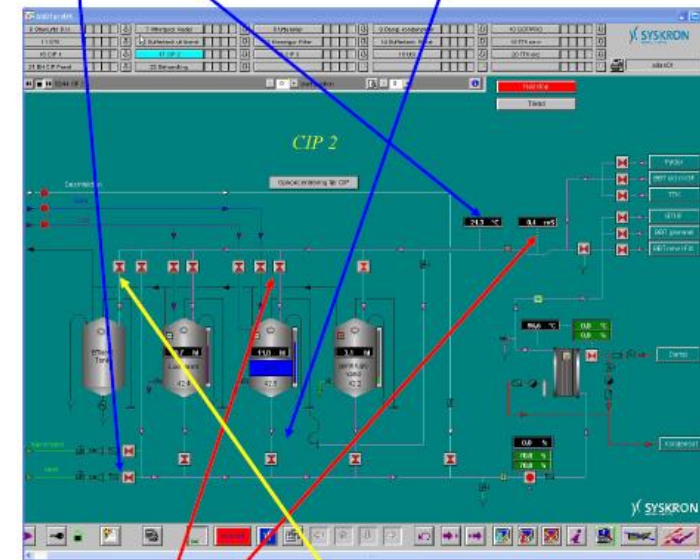
Når manometeret viser 1,5bar er tanken forspændt.

Luk for håndventilerne.

Flyt nu slangen på den lille flowplade fra CO₂ til styret dræn



Når retur temperaturen begynder at falde, åbnes for bundventil på syretanken. Og der lukkes for det kolde vand.



Når ledningsevnehåleren, viser ca. 10 mS

Åbnes tilgang syretank og lukkes for retur effluent tanken

Syren skal nu cirkulere, i 20 min

One-Point Lessons



Example of combined:

- Recipe
- Process Description
- Specification

in one document

Mississippi IPA

India Pale Ale

Type: All Grain **Date:**
Batch Size: 6.00 gal **Brewer:**
Boil Size: 7.42 gal **Asst Brewer:**
Boil Time: 60 min **Equipment:** My Equipment
Taste Rating(out of 50): 40.0 **Brewhouse Efficiency:** 75.0
Taste Notes: Totally Experimental. Very tasty. Tried by several...loved by all. This is a keeper!

Ingredients

Amount	Item	Type	% or IBU
7.25 lb	Pale Malt (2 Row) US (20.0 SRM)	Grain	67.1 %
3.00 lb	Rice, Raw/White (2.0 SRM)	Grain	27.8 %
0.56 lb	Caramel/Crystal Malt - 10L (10.0 SRM)	Grain	5.2 %
3.00 oz	Cascade [4.40%] (60 min)	Hops	41.8 IBU
1.00 oz	Cascade [4.40%] (120 min) (Mash Hop)	Hops	3.0 IBU
1.00 oz	Cascade [4.40%] (15 min) (Aroma Hop-Steep)	Hops	-
1.00 oz	Gypsum (Calcium Sulphate) (Mash 60.0 min)	Misc	
2.00 tsp	Irish Moss (Boil 60.0 min)	Misc	
6.00 gal	Pittsburgh, PA	Water	

Beer Profile

Est Original Gravity: 1.048 SG **Measured Original Gravity:** 1.062 SG
Est Final Gravity: 1.013 SG **Measured Final Gravity:** 1.002 SG
Estimated Alcohol by Vol: 4.6 % **Actual Alcohol by Vol:** 7.8 %
Bitterness: 44.8 IBU **Calories:** 271 cal/pint
Est Colour: 14.0 SRM **Color:**

Mash Profile

Mash Name: Infusion Mash with Precooked Adjuncts **Total Grain Weight:** 10.81 lb
Sparge Water: 2.42 gal **Grain Temperature:** 72.0 F
Sparge Temperature: 168.0 F **Tun Temperature:** 72.0 F
Adjust Temp for Equipment: TRUE **Mash PH:** 5.4 PH

Name	Description	Step Temp	Step Time
Protein Rest	Add 8.65 qt of water at 112.2 F	104.0 F	30 min
Protein Rest	Add 3.24 qt of water at 182.7 F	122.0 F	45 min
Saccharification	Add 7.57 qt of water at 202.7 F	150.0 F	60 min
Mash Out	Add 9.73 qt of water at 208.4 F	168.0 F	10 min

Mash Notes: Long protein rests help to break down starches in precooked adjuncts in preparation for saccharification step.

Carbonation and Storage

Carbonation Type: Corn Sugar **Volumes of CO2:** 2.4
Pressure/Weight: 5.1 oz **Carbonation Used:** 5
Keg/Bottling Temperature: 72.0 F **Age for:** 28.0 days
Storage Temperature: 72.0 F

Notes

FOR THE RICE: Boil 60 minutes to soften and gelatinize. Process as part of the mash.
 **Bottled 9-20-04. Initial taste is GREAT!
 Might reduce the rice to 2# and sparge generously for NEXT try.

Examples of Specifications

Analysis and Specifications of Malting Barley

Parameter	Analysis	Specification
Moisture, %	10.5	Max 14.5 (12.5)
Total protein, d.m., %	9.5	9.5 - 11.5
Total beta-glucan, d.m., %	2.7	Max. 4.0
Germination energy, %	99	Min. 95 (97)
Germination index, %	9.1	Min. 6.0
Germination capacity, %	99	Min. 95 (98)
1000 grain weight, gram	42	Min. 40
Assortment		
-1 (2.8 mm), %	67.0	
-2 (2.5 mm), %	29.0	
-3 (2.2 mm), %	3.0	Max. 8.0
-4 (Reject), %	1.0	Max. 2.0

Analysis and Specifications of Malt

Parameter	Analysis	Specification
Moisture, %	3.9	Max. 4.5
Nitrogen in malt, %	1.71	1.60 - 1.95
Modification, %	94	80 - 95
Homogeneity, %	72	Min. 50
Friability, %	81	Min. 75
Extract, fine, d.m., %	80.4	Min. 80.0
Extract difference, %	1.6	1.2 - 3.2
Saccar. time, min.	10 - 15	Max. 15
Colour, EBC units	4.0	2.8 - 4.2
Viscosity, cP	1.56	1.45 - 1.65
Beta-glucan, mg/l.	185	100 - 300
Soluble nitrogen, d.m., %	0.68	0.64 - 0.74
Assimilable nitrogen, %	0.19	0.16 - 0.20
Kolbach Index	40	36 - 44
Diastatic power. W-K units	249	Min. 220

Example of Beer Analysis with Specification

	Result	Specifications		
		Lower Limit	Target	Upper Limit
Alc, er, ea, ph, col, %P, rdf, avol, sg				
Alcohol, % mas	3,93			
Real extract, %P	3,42			
Apparent extract, %P	1,62			
pH	4,4	4,1	4,3	4,5
Colour, EBC	L 4,8	6,0	7,0	8,0
Original extract, %P	11,08	10,94	11,14	11,34
Real degree of fermentat., %	70,4	68,0	70,0	72,0
Alcohol, % vol	5,00	4,75	5,00	5,25
Bitterness				
Bitterness, BU	L 17	18	20	22
Haze at 20', EBC				
Haze at 20'C, EBC	0,29			0,70
Total haze 5 d. 60', EBC				
Total Haze, 5 d. 60'C, EBC	0,50			3,00
Diacetyl				
Diacetyl, ppb	35			
Head, foam				
Head retention, s	113	100		
Foam volume, ml	472			
CO2				
Carbon dioxide, g/l	H 5,6	4,9	5,2	5,5
SO2				
Sulphur dioxide, ppm	L 2	5	10	15

Specification - Total Oxygen

	All figures in ppb	
	Control limit ⁽¹⁾	Action limit (Production) ⁽²⁾
<u>Beer in Bright Beer Tank</u>		
Dissolved oxygen, target	≤ 100	≤ 150
Dissolved oxygen, upper limit	150	200
<u>Bottled & Canned Beer (Before tunnel pasteuriser⁽³⁾)</u>		
Total oxygen, single sample ⁽⁴⁾	300	400
Total oxygen, individual bottle or can result	500	600
Procedure if specifications are exceeded:		
<ul style="list-style-type: none"> • If upper limit is exceeded a new single sample⁽⁴⁾ is analysed • If this re-analysis exceeds total oxygen upper limit 1 hour is granted to make corrective actions to remedy the high total oxygen level in the package bottles/cans. • Total oxygen, ppm single sample⁽⁴⁾ is analysed 		
STOP the line if the specification is exceeded	300	400

Analysis – Log – Label Information

- **Analysis:**
 - Measurement of the content of a specific parameter in a raw material or product
 - Made in the laboratory
 - No information on how the product is produced
 - No information on which recipe is used
- **Log:**
 - Registration of process conditions for each batch, i.e. temperature, time, extract, etc.
- **Label information - declaration:**
 - A guarantee from the brewery to the consumers and authorities for the content in the product
 - No information on recipes or the process

Traceability

– who wants?

Traceability

Trace the beer all the way back to the raw materials:

- Packaging date & time, line No.
- Bright Beer Tank No.
- Filter run
- Fermentation & maturation tank
- Brew No.
- Raw material used
- Supplier batch No.

Your supplier should also be able to trace one step back to his supplier – and so on!

In many countries regulated by law!

Summary

- Why do we need to have a system of documents?
- Why so many different documents?
- Which types of documents do we need?
- Which purpose does the individual document serve?

Explanation in Danish

Back-up slides

Oversigt over begreberne

Betegnelse	Hvad er det?
Recept	Liste over alle ingredienserne med de mængder, de indgår med – fortæller ikke, hvordan, man laver produktet.
Procesforskrift	Vejledning i fremstilling af en bestemt mængde af et bestemt produkt på et bestemt anlæg.
Analyse	Et laboratories måling af indhold i produkt eller råvare – siger intet om, hvordan produktet er fremstillet, eller hvilken recept, der er anvendt.
Specifikation	Bryggeriets fastsatte grænser for, hvilke analyseværdier, vi vil acceptere for forskellige målte parametre.
Kontrol Log/ Bryg journal	Bryggeriets registrering af procesbetingelser for hver batch, f.eks. af temperaturer og tider.
Deklaration	Bryggeriets garanti til forbrugerne og myndighederne over bestemt indhold i produktet – siger intet om recepten eller processen.