NAPA VALLEY VINTNERS ASSOCIATION TEACHING WINERY

NAPA VALLEY COLLEGE

PROCEDURES MANUAL

Fifth Draft 2007

Prepared by the Students
of
Winery Fall Operations
December, 2001
December, 2002
May & December 2003

Acknowledgements:

Thank you to:
The Napa Valley Vintners Association for generously donating the money to build the teaching winery.
The many wineries, suppliers and individuals who have willingly donated equipment, cash, knowledge and time.
Stacey Hitchcock for collating some of the SOPs into this manual.

Napa Valley College, Viticulture and Winery Technology
Standard Operating Procedure

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Napa Valley College, Viticulture and Winery Technology
Standard Operation Procedures

Gauging Procedure For Stainless Steel Tanks

Developed by Graham Baskerville and Richard Wolf
November 2003

I Introduction

Gauging of containers used to store and process juice and wines provides a fast means to estimate the volume of juice, must or wine in the container. This facilitates the accurate estimation of juice volume for the calculation of additives during processing and for record keeping.

To avoid contamination of the juice/wine by the measuring device it is better to measure the height from the surface of the liquid to a defined reference point, usually the rim of the top opening, rather than measuring the depth of the liquid directly. The tables attached use this measurement method for a 190 gallon/722 liter self-emptying stainless steel tank and a 307 gallon/1164 liter flat bottom stainless steel tank.

The procedure for gauging varies depending upon the type of container. This procedure is for vessels with a bottom outlet/valve, such as a stainless steel tank.

II Equipment

Vessel to be gauged
500 mL measuring cylinder
2L or 4 L jug
20 L bucket
Marking pen
T square graduated rule to reach close to the bottom of the container
Tape measure
Flashlight
Straight edge to bridge the tank opening/frame
Spirit level
Step ladder to safely read levels through top opening
Notebook to record results

III Procedure

1. Place the container to be gauged on a stable, level surface. If there is not sufficient room beneath the bottom valve outlet to accommodate the bucket then raise the tank on a forklift and ensure it is level using a spirit level.
2. Identify the reference point from which measurements are to be made, usually the top of the top flange if a stainless steel tank type container.
3. Close all valves and doors except the top and fill tank with water.
4. Place the straight edge across the frame or tank opening if the opening is larger than the T square bar. Measure the reference point and record. (It may not be zero if a straight edge is used to support the T-square.)
5. To provide adequate resolution, water should be removed from the container in such increments that the container's water level drops about 0.5" for each measurement. For the

tapering top or bottom sections of a tank, 2L or 4L is an appropriate volume to remove for NVC's tanks. For the straight section 20L is appropriate.

6. Use the measuring cylinder to add 2L of water to the jug and carefully mark the water level on the jug. This mark will be used for subsequent filling of the jug.
7. Similarly measure 20L into the bucket and mark that level.
8. Drain 2L of water into the jug from the bottom valve. Throw away this water.
9. Record the height of the surface of the water and the volume of water removed.
10. Repeat steps 8 and 9 until the water level in the container reaches the top of the straight side of the container. If the height change becomes < 0.25" then increase the volume of water removed for each measurement.
11. Once on the parallel section of the tank increase the amount of water removed at each measurement to 20L.
12. At the bottom of the parallel section reduce the amount of water removed at each step to again maintain a measurement approximately every 0.5"
13. When the tank being measured has been drained, open all drain valves and doors to allow the tank to drain and dry. Leave the top cover loosely in place to prevent debris entering the tank while still allowing air to circulate and the sealing gasket to be free.
14. Tabulate the results, showing the height from the surface of the liquid to the reference point, together with columns showing the volume of liquid in both liters and gallons. Ensure that the reference point is clearly identified on the table.
15. Examples for a 190 gallon/722 liter self emptying stainless steel tank and a 307 gallon/1164 liter flat bottom stainless steel tank are attached.
16. In using these tables to measure the volume of juice or wine in a container, ensure that the measuring device has been thoroughly sanitized before use, in accordance with the Sanitizing Procedures in this manual.

Kent Italian Tanks		20.9L per inch		5.525 gals/inch		plus 25 L in the sloping part of the floor				
1000L			DRY TANK GAUGE			The first 2.25inches of the tank are taken up by the lid				
Ins	Gals	Ins	Gals	Ins	Gals	Ins	Gals			
2.25	263.37	14.5	195.73	26.75	128.08	39	60.44			
2.5	261.99	14.75	194.35	27	126.70	39.25	59.06			
2.75	260.61	15	192.97	27.25	125.32	39.5	57.68			
3	259.23	15.25	191.59	27.5	123.94	39.75	56.30		ins	Gals
3.25	257.85	15.5	190.20	27.75	122.56	40	54.92	Base of Tank	-	6.61
3.5	256.47	15.75	188.82	28	121.18	40.25	53.54	Top of Door	12	63.66
3.75	255.09	16	187.44	28.25	119.80	40.5	52.16	Base of Jacket	19	100.80
4	253.71	16.25	186.06	28.5	118.42	40.75	50.78	Top of jacket	30	159.15
4.25	252.32	16.5	184.68	28.75	117.04	41	49.40			
4.5	250.94	16.75	183.30	29	115.66	41.25	48.02			
4.75	249.56	17	181.92	29.25	114.28	41.5	46.64			
5	248.18	17.25	180.54	29.5	112.90	41.75	45.26			
5.25	246.80	17.5	179.16	29.75	111.52	42	43.88			
5.5	245.42	17.75	177.78	30	110.14	42.25	42.50			
5.75	244.04	18	176.40	30.25	108.76	42.5	41.12			
6	242.66	18.25	175.02	30.5	107.38	42.75	39.74			
6.25	241.28	18.5	173.64	30.75	106.00	43	38.36			
6.5	239.90	18.75	172.26	31	104.62	43.25	36.97			
6.75	238.52	19	170.88	31.25	103.24	43.5	35.59			
7	237.14	19.25	169.50	31.5	101.86	43.75	34.21			
7.25	235.76	19.5	168.12	31.75	100.48	44	32.83			
7.5	234.38	19.75	166.74	32	99.10	44.25	31.45			
7.75	233.00	20	165.36	32.25	97.71	44.5	30.07			
8	231.62	20.25	163.98	32.5	96.33	44.75	28.69			
8.25	230.24	20.5	162.60	32.75	94.95	45	27.31			
8.5	228.86	20.75	161.22	33	93.57	45.25	25.93			
8.75	227.48	21	159.83	33.25	92.19	45.5	24.55			
9	226.10	21.25	158.45	33.5	90.81	45.75	23.17			
9.25	224.72	21.5	157.07	33.75	89.43	46	21.79			
9.5	223.34	21.75	155.69	34	88.05	46.25	20.41			
9.75	221.96	22	154.31	34.25	86.67	46.5	19.03			
10	220.57	22.25	152.93	34.5	85.29	46.75	17.65			
10.25	219.19	22.5	151.55	34.75	83.91	47	16.27			
10.5	217.81	22.75	150.17	35	82.53	47.25	14.89			
10.75	216.43	23	148.79	35.25	81.15	47.5	13.51			
11	215.05	23.25	147.41	35.5	79.77	47.75	12.13			
11.25	213.67	23.5	146.03	35.75	78.39	48	10.75			
11.5	212.29	23.75	144.65	36	77.01	48.25	9.37			
11.75	210.91	24	143.27	36.25	75.63	48.5	7.99			
12	209.53	24.25	141.89	36.5	74.25	48.75	6.61			
12.25	208.15	24.5	140.51	36.75	72.87					
12.5	206.77	24.75	139.13	37	71.49					
12.75	205.39	25	137.75	37.25	70.11					
13	204.01	25.25	136.37	37.5	68.73					
13.25	202.63	25.5	134.99	37.75	67.34					
13.5	201.25	25.75	133.61	38	65.96					
13.75	199.87	26	132.23	38.25	64.58					
14	198.49	26.25	130.85	38.5	63.20					
14.25	197.11	26.5	129.46	38.75	61.82					

Gauging Table for 307 Gallon Santa Rosa Stainless Steel Tank				
Serial # 3184				
Height from surface of liquid to top edge of upper lid flange	Contents	Height from surface of liquid to top edge of upper lid flange	Contents	Notes
Inches	US Gallons	cm	Liters	
0	307.50	0.0	1164	Top of upper lid flange
3/8	306.97	1.0	1162	
3/4	306.44	1.9	1160	
1 3/16	305.91	3.0	1158	
1 5/8	305.38	4.1	1156	
2 1/16	304.86	5.2	1154	
2 1/2	304.33	6.4	1152	
2 15/16	303.80	7.5	1150	
3 5/16	303.27	8.4	1148	
3 3/4	302.74	9.5	1146	
4 1/8	302.21	10.5	1144	Bottom of upper lid flange
4 1/2	301.69	11.4	1142	
4 3/4	301.16	12.1	1140	
4 15/16	300.63	12.5	1138	
5 1/8	300.10	13.0	1136	
5 5/16	299.57	13.5	1134	
5 1/2	299.04	14.0	1132	
5 5/8	298.52	14.3	1130	
5 3/4	297.99	14.6	1128	
5 7/8	297.46	14.9	1126	
6	296.93	15.2	1124	
6 1/8	296.40	15.6	1122	
6 1/4	295.87	15.9	1120	
6 3/8	295.35	16.2	1118	
6 1/2	294.82	16.5	1116	
6 5/8	294.29	16.8	1114	Top of straight side section
7 1/2	289.01	19.1	1094	
8 3/8	283.72	21.3	1074	
9 3/16	278.44	23.3	1054	
10 1/16	273.15	25.6	1034	
10 15/16	267.87	27.8	1014	
11 13/16	262.59	30.0	994	
12 11/16	257.30	32.2	974	
13 9/16	252.02	34.4	954	
14 3/8	246.74	36.5	934	
15 1/4	241.45	38.7	914	
16 1/8	236.17	41.0	894	
17	230.89	43.2	874	
17 7/8	225.60	45.4	854	
18 11/16	220.32	47.5	834	
19 9/16	215.04	49.7	814	
20 7/16	209.75	51.9	794	
21 5/16	204.47	54.1	774	
22 1/8	199.19	56.2	754	
23	193.90	58.4	734	
23 7/8	188.62	60.6	714	Top of upper door
24 3/4	183.34	62.9	694	
25 5/8	178.05	65.1	674	
26 1/2	172.77	67.3	654	
27 7/16	167.49	69.7	634	
28 5/16	162.20	71.9	614	
29 3/16	156.92	74.1	594	
30 1/16	151.64	76.4	574	
31	146.35	78.7	554	
31 7/8	141.07	81.0	534	
32 3/4	135.78	83.2	514	
33 5/8	130.50	85.4	494	
34 9/16	125.22	87.8	474	
35 7/16	119.93	90.0	454	
36 5/16	114.65	92.2	434	
37 3/16	109.37	94.5	414	
38 1/16	104.08	96.7	394	Bottom of upper door
38 15/16	98.80	98.9	374	
39 13/16	93.52	101.1	354	
40 11/16	88.23	103.3	334	
41 9/16	82.95	105.6	314	
42 7/16	77.67	107.8	294	
43 5/16	72.38	110.0	274	
44 1/8	67.10	112.1	254	
44 15/16	61.82	114.1	234	
45 3/4	56.53	116.2	214	
46 9/16	51.25	118.3	194	
47 7/16	45.97	120.5	174	
48 5/16	40.68	122.7	154	
49 3/16	35.40	124.9	134	
50	30.12	127.0	114	
50 7/8	24.83	129.2	94	
51 11/16	19.55	131.3	74	
52 9/16	14.27	133.5	54	
53 7/16	8.98	135.7	34	
54 5/16	3.70	138.0	14	
54.9375	0.00	139.5	0	Bottom
				GB & RW 12-18-03

Gauging Table for 190 Gallon Framed Self Emptying Stainless Steel Tank

NVC Asset Tag # 002450/002451

Height from surface of liquid to top edge of upper lid flange	Contents	Height from surface of liquid to top edge of upper lid flange	Contents	Notes
Inches	US Gallons	cm	Liters	
0	190.73	0.0	722	Top of upper lid flange
7/16	190.20	1.1	720	
13/16	189.68	2.1	718	
1 1/4	189.15	3.2	716	
1 5/8	188.62	4.1	714	
2	188.09	5.1	712	
2 7/16	187.56	6.2	710	
2 13/16	187.03	7.1	708	
3 3/16	186.51	8.1	706	Bottom of upper lid flange
3 1/2	185.98	8.9	704	
3 11/16	185.45	9.4	702	
3 7/8	184.92	9.8	700	
4 1/16	184.39	10.3	698	
4 1/4	183.86	10.8	696	
4 7/16	183.34	11.3	694	
4 5/8	182.81	11.7	692	
4 13/16	181.75	12.2	688	
5	180.69	12.7	684	
5 3/16	179.64	13.2	680	
5 3/8	178.58	13.7	676	
5 9/16	177.52	14.1	672	
5 3/4	176.47	14.6	668	
5 15/16	175.41	15.1	664	Top of straight side section
6 1/8	174.35	15.6	660	
7	169.07	17.8	640	
7 13/16	163.79	19.8	620	
8 11/16	158.50	22.1	600	
9 9/16	153.22	24.3	580	
10 3/8	147.94	26.4	560	
11 3/16	142.65	28.4	540	
12 1/16	137.37	30.6	520	
12 15/16	132.09	32.9	500	
13 13/16	126.80	35.1	480	
14 5/8	121.52	37.1	460	
15 1/2	116.24	39.4	440	
16 3/8	110.95	41.6	420	
17 1/4	105.67	43.8	400	
18 1/8	100.39	46.0	380	
19	95.10	48.3	360	
19 7/8	89.82	50.5	340	
20 3/4	84.54	52.7	320	
21 5/8	79.25	54.9	300	
22 1/2	73.97	57.2	280	
23 3/8	68.68	59.4	260	
24 1/4	63.40	61.6	240	
25 1/8	58.12	63.8	220	
26	52.83	66.0	200	
26 7/8	47.55	68.3	180	Bottom of straight side section
27 1/16	46.49	68.7	176	
27 1/4	45.44	69.2	172	
27 7/16	44.38	69.7	168	
27 5/8	43.32	70.2	164	
27 13/16	42.27	70.6	160	
28	41.21	71.1	156	
28 3/16	40.15	71.6	152	
28 3/8	39.10	72.1	148	
28 9/16	38.04	72.5	144	
28 3/4	36.98	73.0	140	
28 15/16	35.93	73.5	136	
29 1/8	34.87	74.0	132	
29 3/8	33.81	74.6	128	
29 9/16	32.76	75.1	124	
29 3/4	31.70	75.6	120	
29 15/16	30.64	76.0	116	
30 3/16	29.59	76.7	112	
30 7/16	28.53	77.3	108	
30 5/8	27.47	77.8	104	
30 7/8	26.42	78.4	100	
31 1/8	25.36	79.1	96	
31 3/8	24.30	79.7	92	
31 11/16	23.25	80.5	88	
31 15/16	22.19	81.1	84	
32 3/16	21.13	81.8	80	Top of lower door
32 1/2	20.08	82.6	76	
32 13/16	19.02	83.3	72	
33 1/8	17.96	84.1	68	
33 7/16	16.91	84.9	64	
33 3/4	15.85	85.7	60	
34 1/8	14.79	86.7	56	
34 1/2	13.74	87.6	52	
34 7/8	12.68	88.6	48	
35 1/4	11.62	89.5	44	
35 5/8	10.57	90.5	40	
36 1/16	9.51	91.6	36	
36 1/2	8.45	92.7	32	
36 15/16	7.40	93.8	28	
37 3/8	6.34	94.9	24	
37 7/8	5.28	96.2	20	
38 1/2	4.23	97.8	16	
39 3/8	3.17	100.0	12	
40 7/16	2.11	102.7	8	
42	1.06	106.7	4	
43	0.53	109.2	2	Bottom of lower valve
	0.00		0	Bottom of lower door
				RW & GB 12-18-03

Criveller 400L tank			10.75L per inch or 2.841gals per inch					
		DRY TANK GAUGE						
Ins	Gals	Ins	Gals	Ins	Gals			
3	105.80	15.5	70.29	28	34.79	3" to lid base		
3.25	105.09	15.75	69.58	28.25	34.08	40.25" to bottom of tank		
3.5	104.38	16	68.87	28.5	33.37	37.2" for holding of liquid		
3.75	103.67	16.25	68.16	28.75	32.66			
4	102.96	16.5	67.45	29	31.95			
4.25	102.25	16.75	66.74	29.25	31.24			
4.5	101.54	17	66.03	29.5	30.53			
4.75	100.83	17.25	65.32	29.75	29.82			
5	100.12	17.5	64.61	30	29.11			
5.25	99.41	17.75	63.90	30.25	28.40			
5.5	98.70	18	63.19	30.5	27.69			
5.75	97.99	18.25	62.48	30.75	26.98			
6	97.28	18.5	61.77	31	26.27			
6.25	96.57	18.75	61.06	31.25	25.56			
6.5	95.86	19	60.35	31.5	24.85			
6.75	95.15	19.25	59.64	31.75	24.14			
7	94.44	19.5	58.93	32	23.43			
7.25	93.73	19.75	58.22	32.25	22.72			
7.5	93.02	20	57.51	32.5	22.01			
7.75	92.31	20.25	56.80	32.75	21.30			
8	91.60	20.5	56.09	33	20.59			
8.25	90.89	20.75	55.38	33.25	19.88			
8.5	90.18	21	54.67	33.5	19.17			
8.75	89.46	21.25	53.96	33.75	18.46			
9	88.75	21.5	53.25	34	17.75			
9.25	88.04	21.75	52.54	34.25	17.04			
9.5	87.33	22	51.83	34.5	16.33			
9.75	86.62	22.25	51.12	34.75	15.62			
10	85.91	22.5	50.41	35	14.91			
10.25	85.20	22.75	49.70	35.25	14.20			
10.5	84.49	23	48.99	35.5	13.49			
10.75	83.78	23.25	48.28	35.75	12.78			
11	83.07	23.5	47.57	36	12.07			
11.25	82.36	23.75	46.86	36.25	11.36			
11.5	81.65	24	46.15	36.5	10.65			
11.75	80.94	24.25	45.44	36.75	9.94			
12	80.23	24.5	44.73	37	9.23			
12.25	79.52	24.75	44.02	37.25	8.52			
12.5	78.81	25	43.31	37.5	7.81			
12.75	78.10	25.25	42.60	37.75	7.10			
13	77.39	25.5	41.89	38	6.39			
13.25	76.68	25.75	41.18	38.25	5.68			
13.5	75.97	26	40.47	38.5	4.97			
13.75	75.26	26.25	39.76	38.75	4.26			
14	74.55	26.5	39.05	39	3.55			
14.25	73.84	26.75	38.34	39.25	2.84			
14.5	73.13	27	37.63	39.5	2.13			
14.75	72.42	27.25	36.92	39.75	1.42			
15	71.71	27.5	36.21	40	0.71			
15.25	71.00	27.75	35.50	40.25	0.00			

Napa Valley College, Viticulture and Winery Technology
Standard Operation Procedure

Gauging Procedure For Keg Type Containers

Developed by Richard Wolf and Graham Baskerville
November 2003

I Introduction

Gauging of containers used to store and process juice and wines provides a fast means to estimate the volume of juice, must or wine in the container. This facilitates the accurate estimation of juice volume for the calculation of additives during processing and for record keeping.

To avoid contamination of the juice/wine by the measuring device, it is better to measure the height from the surface of the liquid to a defined reference point, usually the rim of the top opening, rather than measuring the depth of the liquid directly. The table attached uses this measurement method for a 15 gallon/59 liter stainless steel keg.

The procedure for gauging varies depending upon the type of container. This procedure is for opaque vessels with no bottom outlet/valve, such as a stainless steel keg.

II Equipment

Vessel to be gauged
500 mL measuring cylinder
2 L or other appropriately sized jug
Marking pen
Metal rod at least 6" longer than the depth of the container
(A second similar metal rod will be required if the container is non conducting)
Tape measure
Electrical resistance meter
Notebook to record results

III Method

It is not possible to visually measure the liquid level in an opaque container with a small opening, so a metal rod is used as an electrical probe with an ohm-meter (electrical resistance meter) connected between the tank and the probe. A small amount of citric acid (100 grams) can be included in the first measuring cylinder of water to improve the electrical conductivity of the water. As the probe is inserted into the container the electrical resistance will drop immediately upon the probe contacting the water. When this happens, put a mark on the probe, level with the reference point of the container and then remove the probe from the container. Measure the distance from the tip of the probe to the mark. This is the distance from the water to the reference point and should be recorded.

Care must be taken to keep the probe from contacting the neck of the container, as this could give an erroneous result.

If the container is non-conducting, insert a second conducting probe into the water to provide the required electrical continuity.

IV Procedure

17. Place the container to be gauged on a stable, level surface.
18. Identify the reference point from which measurements are to be made, usually the top of the threaded flange if a stainless steel keg type container.
19. Measure the depth of the container from the reference point to the bottom of the container. Record.
20. To provide adequate resolution, water should be removed from the container in such increments that the container's water level rises about 0.5" for each measurement. For a 15 gallon keg, 2L is an appropriate volume to add.
21. Using the measuring cylinder, add 2L of water to a suitably sized jug and carefully mark the water level on the jug. This mark will be used for subsequent filling of the jug.
22. Pour 2L of water from the jug into the container.
23. Measure the distance from the surface of the water to the reference point, using the method described above, and record both this distance and the volume of water added.
24. Repeat steps 6 and 7 until the water level in the container reaches the top of the straight side of the container
25. Near the top of the container it may be necessary to add water in smaller increments to accurately measure the full volume.
26. If the container does not have parallel sides then it will be necessary to add water in smaller increments as the diameter reduces in order to get measurements approximately every 0.5"
27. Tabulate the results, showing the height from the surface of the liquid to the reference point, together with columns showing the volume of liquid in both liters and gallons. Ensure that the reference point is clearly identified on the table.
28. An example for a 15 gallon stainless steel keg is attached.
29. In using these tables to measure the volume of juice or wine in a container, ensure that the measuring device has been thoroughly sanitized before use, in accordance with the Sanitizing Procedures in this manual.
30. If the probe and ohm-meter are not available, then a wooden dowel stirring rod can be used as follows: ensure it has been sanitized, in accordance with the Sanitizing Procedures in this manual, and is sufficiently dry to be able to see where the liquid level comes to on the rod. Then insert into the tank until it is below the liquid level and mark the reference point level on the rod. Remove the rod and measure the distance from the reference point mark to the mark left by the container liquid. This is the distance from the liquid level to the reference point. Dry the rod for the next measurement.

Gauging Table for 15 Gallon Stainless Steel Keg

Height from surface of liquid to outer edge of threaded flange	Contents	Height from surface of liquid to outer edge of threaded flange	Contents
Inches	US Gallons	cm	Liters
21 3/4	0.00	55.2	0.00
20 3/16	0.53	51.3	2.00
19 1/2	1.06	49.5	4.00
18 7/8	1.59	47.9	6.00
18 1/4	2.11	46.4	8.00
17 5/8	2.64	44.8	10.00
17	3.17	43.2	12.00
16 5/16	3.70	41.4	14.00
15 5/8	4.23	39.7	16.00
15	4.76	38.1	18.00
14 3/8	5.28	36.5	20.00
13 3/4	5.81	34.9	22.00
13 1/16	6.34	33.2	24.00
12 3/8	6.87	31.4	26.00
11 3/4	7.40	29.8	28.00
11 1/8	7.93	28.3	30.00
10 1/2	8.45	26.7	32.00
9 7/8	8.98	25.1	34.00
9 1/4	9.51	23.5	36.00
8 9/16	10.04	21.7	38.00
7 15/16	10.57	20.2	40.00
7 5/16	11.10	18.6	42.00
6 11/16	11.62	17.0	44.00
6	12.15	15.2	46.00
5 3/8	12.68	13.7	48.00
4 3/4	13.21	12.1	50.00
4 1/16	13.74	10.3	52.00
3 7/16	14.27	8.7	54.00
2 13/16	14.79	7.1	56.00
2 1/8	15.32	5.4	58.00
1 7/8	15.45	4.8	58.50
1 1/2	15.59	3.8	59.00
			RW & GB 11-15-03

	Gauging Table for 50L Milk kegs (13.21gals)						
Ins	Gals	Ins	Gals				
0	13.21004	10.25	6.439894				
0.25	13.04491	10.5	6.274769				
0.5	12.87979	10.75	6.109643		Kegs are 20ins high (50.8cm)		
0.75	12.71466	11	5.944518		diameter of 14 5/8 ins (37.14cm)		
1	12.54954	11.25	5.779392				
1.25	12.38441	11.5	5.614267				
1.5	12.21929	11.75	5.449141				
1.75	12.05416	12	5.284016				
2	11.88904	12.25	5.11889				
2.25	11.72391	12.5	4.953765				
2.5	11.55878	12.75	4.788639				
2.75	11.39366	13	4.623514				
3	11.22853	13.25	4.458388				
3.25	11.06341	13.5	4.293263				
3.5	10.89828	13.75	4.128137				
3.75	10.73316	14	3.963012				
4	10.56803	14.25	3.797886				
4.25	10.40291	14.5	3.632761				
4.5	10.23778	14.75	3.467635				
4.75	10.07266	15	3.30251				
5	9.90753	15.25	3.137384				
5.25	9.742404	15.5	2.972259				
5.5	9.577279	15.75	2.807133				
5.75	9.412153	16	2.642008				
6	9.247028	16.25	2.476882				
6.25	9.081902	16.5	2.311757				
6.5	8.916777	16.75	2.146631				
6.75	8.751651	17	1.981506				
7	8.586526	17.25	1.81638				
7.25	8.4214	17.5	1.651255				
7.5	8.256275	17.75	1.486129				
7.75	8.091149	18	1.321004				
8	7.926024	18.25	1.155878				
8.25	7.760898	18.5	0.990753				
8.5	7.595773	18.75	0.825627				
8.75	7.430647	19	0.660502				
9	7.265522	19.25	0.495376				
9.25	7.100396	19.5	0.330251				
9.5	6.935271	19.75	0.165125				
9.75	6.770145	20	0				
10	6.60502						

Napa Valley College, Viticulture and Winery Technology
Standard Operation Procedure

Gauging Procedure For Carboy Containers

Developed by Graham Baskerville and Richard Wolf
November 2003

I Introduction

Gauging of containers used to store and process juice and wines provides a fast means to estimate the volume of juice, must or wine in the container. This facilitates the accurate estimation of juice volume for the calculation of additives during processing and for record keeping.

To avoid contamination of the juice/wine by the measuring device it is better to measure the height from the surface of the liquid to a defined reference point, usually the rim of the top opening, rather than measuring the depth of the liquid. The table attached uses this measurement method for a 3 gallon/11 liter glass carboy.

The procedure for gauging varies depending upon the type of container. This procedure is for clear vessels with no bottom outlet/valve, such as a carboy.

II Equipment

Vessel to be gauged
500 mL measuring cylinder
Stiff tape measure or a solid metal/plastic rule at least 6" longer than the container is deep
Notebook to record results

III Procedure

31. Place the container to be gauged on a stable, level surface where the level of fluid and the measuring device can easily be viewed.
32. Identify the reference point from which measurements are to be made, usually the top of the rim if a carboy type container.
33. Measure the depth of the container from the reference point to the bottom of the container. Record.
34. Fill the measuring cylinder with water to a level such that when added to the container the container's water level rises about 0.5". For a 3 gallon carboy, 500 mL is an appropriate volume to add.
35. Measure the distance from the surface of the water to the reference point and record both this distance and the volume of water added.
36. Repeat steps 4 and 5 until the water level in the container reaches the top of the straight side of the container
37. Then continue with steps 4 and 5 but using a smaller volume of water to again provide about 0.5" rise in water level. For the 3 gallon carboy 250 mL is appropriate.
38. Tabulate the results, showing the height from the surface of the liquid to the reference point, together with columns showing the volume of liquid in both liters and gallons. Ensure that the reference point is clearly identified on the table.
39. An example for a 3 gallon carboy is attached.

40. In using these tables to measure the volume of juice or wine in a container, ensure that the measuring device has been thoroughly sanitized before use, in accordance with the Sanitizing Procedures in this manual.

5 gal Carboy Dry Measure			**30gal Trash Can Dry Measure**		1" = 1.3gal
Volume (Gals)	Dry Measure(ins)		Volume (Gals)	Dry Measure(ins)	
0	18.625		1	31.2	
0.25	17.75		2	29.9	
0.5	17.25		3	28.6	
0.75	16.875		4	27.3	
1	15.875		5	26	
1.25	15.25		6	24.7	
1.5	14.5		7	23.4	
1.75	13.625		8	22.1	
2	13.125		9	20.8	
3	10.25		10	19.5	
4	7.875		11	18.2	
4.25	7		12	16.9	
4.5	6.25		13	15.6	
4.75	5.625		14	14.3	
5	4.75		15	13	
5.125	3.625		16	11.7	
5.1875	0		17	10.4	
			18	9.1	
			19	7.8	
			20	6.5	
			21	5.2	
			22	3.9	
			23	2.6	
			24	1.3	
			25	0	

Gauging Table for 3 Gallon Glass Carboy

Height from surface of liquid to top of carboy rim	Contents	Height from surface of liquid to top of carboy rim	Contents
Inches	US Gallons	cm	Liters
15 3/4	0.00	40.0	0.00
15 5/16	0.13	38.9	0.50
14 13/16	0.26	37.6	1.00
14 5/16	0.40	36.4	1.50
13 13/16	0.53	35.1	2.00
13 5/16	0.66	33.8	2.50
12 3/4	0.79	32.4	3.00
12 1/4	0.92	31.1	3.50
11 3/4	1.06	29.8	4.00
11 1/4	1.19	28.6	4.50
10 3/4	1.32	27.3	5.00
10 3/16	1.45	25.9	5.50
9 11/16	1.59	24.6	6.00
9 1/8	1.72	23.2	6.50
8 5/8	1.85	21.9	7.00
8 1/16	1.98	20.5	7.50
7 9/16	2.11	19.2	8.00
7	2.25	17.8	8.50
6 1/2	2.38	16.5	9.00
6	2.51	15.2	9.50
5 1/2	2.64	14.0	10.00
5	2.77	12.7	10.50
4 3/8	2.91	11.1	11.00
4	2.97	10.2	11.25
3 3/8	3.04	8.6	11.50
			GB & RW 11-15-03

Napa Valley College, Viticulture and Winery Technology
Standard Operating Procedure

Cleaning and Sanitation Procedures

Developed by Timm Crull, Nancy Barnet-Moore and Gerry Ritchie
December 2001, 2005

I Introduction

The cellar and the equipment used in all winemaking process must be maintained and used in a clean and sanitized environment, thus avoiding contamination of wine with spoilage organisms. Chlorine and Iodine should not be used as sanitizers because of the risk of TCA formation. Maintaining the winery and equipment clean at all times is the first step in minimizing contamination by spoilage organisms.

II General Cleaning Equipment

Water source
Pressure washer
Scotch Bright pads
Protective eye wear
Barrel washing spray ball
2 gallon hand sprayer for Quat
Water hose with adjustable spray gun
Cleaning brushes
5 gallon buckets
Gloves
Small flashlight

III General Chemicals

Soda Ash / Sodium bicarbonate
Caustic soda / Sodium Hydroxide
Chemco 40
Proxy Clean
Citric Acid
Bio Quat
Potassium metabisulfite (KMBS)
Vodka

IV Procedures

Summary

Procedure	Uses	Chemicals
Three Cycle Wash	The major method for cleaning stainless steel and non porous plastic tanks, equipment & surfaces. When equipment is to be used for white wines just after it has been used for red wines	Chemco / Caustic Soda / Soda Ash / Proxy Clean Citric Acid / Peracetic acid KMBS Water
Quat	Sanitize equipment and surfaces that are already clean	BioQuat Water
Sulfur Dioxide (SO_2)	Sanitize equipment and surfaces that are already clean	KMBS Citric acid Water
Alcohol	Sanitize equipment that is already clean	Vodka (highest strength)
Barrel Cleaning	Barrels	**WATER** OR **OZONE <u>ONLY</u>**!

Three cycle wash

The three cycle wash is used to clean and sanitize a wide variety of winery equipment, including: tanks, fittings, transfer hoses and pumps, filters, and most other non-porous surfaces. In theory, it consists of an alkali wash (cycle 1), followed by an acid wash / sanitize step (cycle 2) and then a thorough rinse with water (cycle 3). In reality, there are several steps in the process.

Now that we cannot use chlorine as a sanitizer, we have substituted 50ppm SO_2 in the acid cycle of the three cycle wash. The concentration is lower than when using the SO_2 sanitizer solution (see p.23) because there is a longer contact time in this method.

In order to speed up the cleaning and sanitizing procedure at the NVC Winery, we have one picking bins that contains the alkali and another that contains the acid/SO_2 solution. Any appropriate piece of equipment that can fit in the bins can be immersed in the solution and left to soak which minimizes the amount of scrubbing required.

Three cycle wash should not be used on the inside of barrels or wooden tanks.

Preparation of Picking Bins of Caustic Soda and Citric Acid / SO_2

Fill each picking bin with water (from the faucet) to 6inches below the top (i.e. 130gals). Weigh out the appropriate quantities of caustic soda, citric acid and KMBS as given in Table 2 and place each chemical in a separate 5 gal bucket. Pulverise any large lumps of chemical as this will speed up their dissolution. Add water to each bucket, carefully and dissolve as much of each chemical before tipping it into the appropriate picking bin. The caustic soda bin is always on the left as you face them on the crush pad. Thoroughly dissolve all the chemical before using the solution.

I Procedure

1 Assess surface to be cleaned
  a If no surface debris, proceed to step 3.
2 Debris removal
  a Use pressure washer, brushes, scrapers, and/or scotch bright pads to remove all surface debris, including but not limited to grape skins, pomace, tartrates, and visible molds.
3 Rinse with water
  a Rinse with water to remove gross, loose soil.
4 Wash with alkaline cleaning agent (Soda Ash / Caustic Soda / Chemco 40)
  wear gloves and protective eye wear.
  a Make up a 1% Soda Ash solution using Table 1.1
  b For equipment: Remove all residual soil with a 1% Soda Ash solution by appropriate scrubbing with a brush and/or scotch bright pads.
    i If soaking in the alkali bin , soak for 10mins
  c For tanks: Use a tank spray ball and circulate 1% Soda Ash solution for 20 minutes.
5 Rinse with water
  a Removal and rinsing of Soda Ash residue and any debris with clean water (3 min using spray ball for tanks).
6 Rinse with acidic cleaning agent (Citric acid)
  a Mix a 1% Citric acid plus 0.01% SO_2 solution using table 1.2
  b For equipment: Thoroughly wash all surfaces with the citric acid solution, making sure to wear gloves and protective eye wear.
    i If soaking in the acid/SO_2 bin, soak for 5min).
  c For tanks: If using tank spray washers 1% citric/SO_2 solution should continue to circulate for 15 minutes
7 Rinse with water
  a Remove and rinse away citric residue with clean water (5min) until water tastes acid free.

Solution Mixing Guidelines

Table 1.1 Soda Ash / Caustic Soda Approx. 1% Solution

Gallons of Water	Liters of Water*	Grams of Caustic Soda*	Ounces of Caustic Soda	Approximate quantity in ml (100g= 80 ml)
0.25	1.0	10	0.5	8
1.0	3.8	38	1.5	30
2.0	7.6	76	3	61
3.0	11.4	114	4	91
4.0	15	150	57	121
5.0	19	190	7	151
10.0	38	380	13	303
20.0	76	760	27	606
50.0	190	1900	66	1514
100.0	380	3800	132	3028
130.0	490	4900	174	3936

* numbers have been rounded to nearest whole number for convenience

Table 1.2 Citric for an approx. 1% Solution and KMBS for an approx 50ppm SO_2 solution

Gallons of Water	Liters of Water*	Grams of Citric*	Ounces of Citric*	Approximate Citric in ml (100 g = 92 ml)	Grams of KMBS*
0.25	1.0	10	0.5	8.7	0.1
1.0	3.8	38	1.5	35	0.4
2.0	7.6	76	3	70	0.8
3.0	11.4	114	4	104	1.2
4.0	15	150	57	140	1.6
5.0	19	190	7	174	2
10.0	38	380	13	348	4
20.0	76	760	27	696	8
50.0	190	1900	66	1741	20
100.0	380	3800	132	3482	40
130.0	490	4900	174	4527	50

* numbers have been rounded to nearest whole number for convenience

Table 2 Approx. Three-Cycle Wash Quantities

	Scoops of	
Container	Soda Ash	Citric
5gal bucket / FYB (4gal)	½	½
264gal tanks	2	2
30gal trash can (25gal)	3	3½
50gal trash can (45gal)	5½	6½
½ ton picking bin (~130gal)	15	17 + 50g KMBS

1 scoop = 1 cup = 8 fl. Oz. = 250ml

Sanitizing with Quat

Quat can be used on a wide variety of winery equipment, including: presses, destemmer-crushers, tanks, fittings, transfer hoses and pumps, filters, walls, and floors. It should not be used on the **inside** of barrels or wooden tanks. It can be used on the wooden slats of a basket press. The active sanitizer Quat (Quaternary Ammonium Compounds) is highly water soluble, colorless, tasteless, and has low toxicity and are non-corrosive. The residual activity of Quat allows solutions sprayed on walls, floors and ceilings to inhibit mold growth.

Procedure

1 Assess surface to be cleaned, if any visible surface debris proceed to the three cycle wash.
2 Apply Quat
- *a* For fittings and tools: make up a solution of 200ppm Quat per Table 1.3 into a 5 gallon bucket. Submerge and remove the object to be sanitize and allow to sit for 15 minutes
- *b* For large equipment (that cannot be submerged): use the 2 gallon tank sprayer with a solution of 200ppm Quat (see Table 1.3 for quantities). Spray a liberal amount to all surface areas and leave for 15 minutes.
- *c* For Walls (that have a coating of mold): use the 2 gallon tank sprayer with a solution of 200ppm Quat (see Table 1.3 for quantities). Spray a liberal amount on the wall and leave. DO NOT RINSE WALLS WITH WATER

3 Rinse with water
- *a* Remove all Quat residues on equipment with through rinsing with cold water.

Table 1.4 - Quat 200 PPM Solution

Gallons of Water	Liters of Water*	Quantity of Bio-Quat (fluid oz.)	Quantity of Bio-Quat (ml)
0.25	1.0	0.03	0.784
1.0	3.8	0.13	3.750
2.0	7.6	0.25	7.500
3.0	11.4	0.38	11.250
4.0	15	0.50	15.000
5.0	19	0.63	18.750
10.0	38	1.25	37.500
20.0	76	2.50	75.000
50.0	190	6.25	187.500
100.0	380	12.50	375.000

* numbers have been rounded to nearest whole number for convenience

Sanitizing with SO_2 solutions

Sulfur dioxide is used to sanitize only equipment that is already clean! It can be used on small winery equipment, including: fittings, small diameter hoses, wine thieves and for sanitizing filtration systems. The acid concentration is lower than in the 3 cycle wash because it is being used to lower the pH of the solution rather than clean the equipment. The SO_2 concentration is higher because the contact time is much shorter.

Preparation

Make up a solution of 0.1% SO_2 and 0.5% citric acid. Use the following table or Table 2 to work out the quantities required for different volumes of water.

Gallons Water	Grams KMBS for 0.1% SO_2 soln.	Grams Citric acid for 0.05% soln.
1	7.56	1.89
5	37.8	9.45
15	113.4	28.35
30	227.1	56.7
50	378.5	94.6
60	454.2	113.6
80	605.6	151.4

1 Weigh out the appropriate quantities of KMBS and citric acid.
2 Dissolve the citric acid in about 50% of the water.
3 Add the KMBS and make the volume up to the full amount
4 Dissolve thoroughly before use

Procedure

1 Assess equipment to be sanitized, if any visible surface debris or stains, proceed to the three cycle wash.
2 Immerse in SO_2 solution
  - *a* For small equipment:. Submerge the object to be sanitized for 1 minute. Glass wine thieves can be left soaking in the SO_2 solution after cleaning.
  - *b* For large equipment see individual procedures in manual.

3 Rinse with water
  - *a* Rinse thoroughly with cold water immediately before use.

SO_2 Sanitizer Quantities

Compound	Quantity for		
	5gal	25gal	45gal
Grams KMBS for 0.1% SO_2	40 grams	200 grams	340 grams
0.01% citric for SO_2 soln	10 grams	48 grams	85 grams
200ppm Quat	20 ml	100 ml	180 ml

Sanitizing with Alcohol

Alcohol is used to sanitize only! It can be used on small winery equipment, including: valves, fittings, wine thieves, stirrers.

Materials

Use the highest strength Vodka you can find (~ 70%)
1L spray bottle

Procedure

1. Assess equipment to be sanitized, if any visible surface debris or stains, three cycle wash before sanitizing.
2. Spray equipment or surface liberally with alcohol using the spray bottle.
3. Let the alcohol evaporate before using the equipment or surface.

Barrels

Cleaning

"Sweet Barrels" require thorough cleaning after each use and prior to the next use. Times for cleaning vary with the age of the barrel and the condition of the wine and/or lees that are present. In all cases make sure to inspect and smell barrels for faults prior to re-use.

1 Clean exterior surface with pressure washer

2 Attach the barrel-washing wand to the hose. Insert wand into barrel in the bung down position. Rinse barrel according to the following table, or until outflow is clear and taste is clean. If tartrates are present use a flashlight to check for removal and increase hot wash time if needed.

Barrel Age	Water	If clean	If heavy lees	If tartrates
New	Hot	None	None	None
	Cold	2 minutes	2 minutes	2 minutes
1 to 2 years	Hot	30 seconds	45 seconds	1 minute
	Cold	2 – 3 minutes	2 – 3 minutes	2 – 3 minutes
> 2 years	Hot	45 seconds	60 seconds	90 seconds
	Cold	3 minutes	3 minutes	3 minutes

3 In the bung down position, allow the barrel to drain. It is now ready to fill or store.

4 If storing: allow the barrel to drain for 24 hrs, apply 5 seconds of SO_2 gas(making sure to wear the SO_2 respirator). Insert the bung and move the barrel so that the bung is in the 8 o'clock position.

Maintenance of stored empty Barrels

This process is to be carried out every 4 weeks

1 Smell barrel for VA and other undesirable aromas. Separate out any barrels that have problems and do not use for storing wine.

2 While wearing an SO_2 respirator (stored in the Winery Lab), apply 5 seconds of SO_2 gas from the SO_2 cylinder. Insert the bung and move the barrel so that the bung is in the 8 o'clock position

Napa Valley College, Viticulture and Winery Technology
Standard Operation Procedure

Barrel Preparation

Developed by Gordon Kuang and Gerry Ritchie
December 2003

I Introduction

Barrels are made in a wide range of sizes, sources, seasoning of staves, and toasting depending on the intended use. Many of the benefits of barrel use come from the relatively large surface area of the barrels. As with most winemaking practices, opinions differ considerably on whether and how to condition barrels.

II Equipment

Flashlight
Water Source
Siphon hoses
Barrel Washer

III Procedure

Optimum Procedure when there are no time limits or water shortages

41. Inspect the inside of the barrel for any imperfections
42. Fill the barrel completely with water and leave overnight
43. Use several siphon tubes to begin the emptying of the barrel.
44. When the barrel is light enough, spin it around so that it is bung-hole down and let drain.
45. The barrel should be filled within 24 hours

Procedure when there are time constraints / Water issues

1. Put 10gals of water in the barrel, role it around on its side for a few minutes.
2. Tip onto one head and leave for 10mins.
3. Tip onto side and repeat rolling in step 1
4. Tip onto other head and leave for 10mins
5. Use a hose and spray gun to wet the outside of the barrel

Pressure Washing procedures

Developed By Joe Curley
December 2003

I Introduction

The gasoline portable pressure washer is used for the general cleaning of the winery and the equipment used in the winery and its operation.

It should be noted that the "use of this pressure washer should be used outside only" as it runs on gasoline and produces harmful vapors.

II Equipment

KARCHER – Model 2400 Pressure Washer
Equipped with Honda GC 160 Engine

Support Equipment includes:
Pressure Hose
Wand and 5 Color-Coded Tips for Cleaning
Detergent Attachments
Water Hose
Wear safety glasses.

III Preparation

1. Check both the oil level on engine and the gasoline in the fuel tank.
2. Connect supply water hose to pressure washer (turn on).
3. Take washing wand and depress trigger to release trapped air in lines.
4. Close choke on engine.
5. Move gas throttle approximately one-third to one-half way to Fast position.
6. Pull starter cord to start.
7. When running, slowly open choke for smooth, clean running.

IV Operation

1. Check to see if water flow is adequate.
2. Choose the proper tip (colored nozzle) for the job.
3. Check for proper ventilation of running equipment.
4. Select item or area to be washed. Note: Use care when washing wood as to not "grain" wood with too much pressure from machine.
5. Pressure can be regulated by the speed of the engine and the proper tip on the wand.
6. Avoid keeping nozzle in or on the same area for a prolonged time.

V Shutting Down and Clean Up

1. If using detergent, remove suction from pail or bucket.
2. Press engine throttle down to shut off engine.
3. Turn off water supply.
4. Release pressure in line by squeezing wand handle.
5. Disconnect water supply.
6. Lock trigger lock on nozzle handle.
7. Roll up hose (pressure), place on side hanger.
8. Place wand in holder.
9. Make sure all nozzle tips are replaced in their nozzle holders.
10. Check gas and oil levels. Fill, if needed, for the next person to operate.

Napa Valley College, Viticulture and Winery Technology
Standard Operation Procedure

Ozone Sanitation

Developed by Jessica Loring, Theo Papathanasis and Chris Vallerga
December 2002

I Introduction

The ozone machine can be used to sanitize wine barrels, tanks, the winery floor, walls and other equipment. **The ozone machine does not clean; it only sanitizes.** Therefore it is important to wash floors and walls first to clean them and rinse them before applying ozonated water to kill residual microbes and bacteria.

II General Cleaning Equipment

McClain Ozone Machine
2 garden hoses
1 five gallon bucket
1 barrel washer wand
2 adapters to convert 1 ½" tri-clamp to ¾ inch male hose screw thread

III Procedure

Turning on and operating the McClain Ozone Machine:

46. Roll the McClain Ozone machine to the outdoor pad at the rear of the winery.
47. Bring out to the pad the barrels and mobile equipment you wish to sanitize.
48. Attach one end of a hose to the water faucet and the other end of that hose to the inlet valve on the McClain Ozone machine using one tri-clamp adapter.
49. Attach the other hose to the outlet valve on the McClain Ozone machine using the other tri-clamp adapter. Afix the barrel washer wand to the other end of that hose.
50. **Never operate the McClain Ozone Machine without having the garden hoses hooked up to the Inlet and Outlet Valves.**
51. Plug in the McClain Ozone machine
52. Turn on the water at the faucet
53. Turn on the "on/off" switch on the Ozone machine. The green operation light will come on.
54. Fill the 5 gallon bucket with water that is coming out of the outlet hose. When the water ceases to have bubbles in it, the water is ready to be ozonated.
55. Turn on and adjust the "Ozonation" knob. The yellow ozonation light will come on to indicate that the water is being ozonated.
56. **<u>Important Safety Procedure: Measure Air To Check For Ozone</u> Use the air testing meter to check that there is NO ambient ozone in the air. Simply turn on the switch and read the dial which indicates if ozone is present. If the meter indicates ANY ozone in the air, immediately shut off the machine and call the manufacturer at (707) 226-1250 for assistance. [The OSHA standard for ozone in the work place is .01ppm for an 8 hour work day. However, you want NO ozone in the air.]**

57. To check the amount of ozone in the ozonated water, use the modified hot chlorine kit. (It is similar to the kits used to check chlorine in swimming pools, but has slightly different chemicals.) Follow the steps below:

    [WARNING: The chemicals in the kit may be hazardous to the health and safety of the user if inappropriately handled. Read all warnings before performing the test and use appropriate safety equipment.]

    A. Fill the flask to the 40 mL mark with the water to be tested. Take the sample water from the bottom ½ of the 5 gallon bucket so that the ozone is not lost to the atmosphere.
    B. Tear open one Sulfite 1 Regent Powder Pillow. Add contents to the flask. Swirl to mix.
    C. Tear open one Sulfamic Acid Powder Pillow. Add the contents to the flask. Swirl gently to mix. If Ozone is present a blue color will develop. This is the **prepared sample.**
    D. Measure 10 mL of the **prepared sample** and pour it into the graduated cylinder.
    E. Add Sodium Thiosulfate Standard Solution ("titrate solution") drop by drop to the mixing bottle. Hold the dropper vertically above the bottle to add the drops. Swirl the bottle consistently while adding the drops and count each drop as it is added. Continue to add titrate solution until the sample bottle becomes colorless.
    F. Calculate the amount of ozone in the water. Each drop used to bring about the color change in step 5 is equal to 0.68 mg/L Ozone.

13. The time needed to sanitize the equipment is based upon the concentration of ozone in the water. Refer to the table below:

CONCENTRATION OF OZONE IN WATER	TIME IN MINUTES	TOTAL MINUTES NEEDED TO SANITIZE
4 PPM OZONE	5 MINUTES	4x5=20 MINUTES
7 PPM OZONE	3 MINUTES	7x3=21MINUTES
10 PPM OZONE	2 MINUTES	10x2=20 MINUTES

14. Barrel Washing

A. Turn the barrel so the bung hole is facing downward.
B. Attach barrel-washing wand to the hose. Insert wand into the barrel in the bung down position. Rinse barrel for 5 minutes if you suspect it has bacterial contamination and for 1 minute if the barrel if you do not suspect bacterial contamination.
C. Let the barrel drain for 30 minutes because ozone has a 30 minutes half-life.
D. Refill barrel with wine or let drain for 2 to 17 hours before adding SO_2.

15. Winery Floor and Wall Washing

To wash walls and winery floors spray ozonated water on the surfaces. They are cleaned by contact with the water.

16. Shutting down the McClain Ozone Machine

To shut down the Ozone Machine reverse steps 1 through 8 above. For technical assistance or service call (707) 226-1250.

Napa Valley College, Viticulture and Winery Technology
Standard Operating Procedures

Tank Cleaning Procedures

Developed by Tony Kolonie, Louis Horta, John Starr and Miguel Avina
December 2002

I Introduction

Tanks must be cleaned and sanitized before use to ensure there is no contamination of the receiving wine by undesirable debris, dirt or micro-organisms.

II Cleaning equipment

Compressed air
Air pump
1 inch suction hose
1 inch discharge hose
Spray ball
Tri-clamp fitting
Gasket between fittings
Elbow fitting
Cleaning brushes
Bucket
Measuring cup
Spray nozzle
Adapter fitting
Tarpaulin

III Chemicals

Soda Ash
Water
Citric Acid
KMBS

IV Equipment setup

A circulating system must be set up, to develop a complete circulation of water moving out of the bottom valve of a tank into a 5gal bucket. The water is then pulled out of the bucket by a pump, and pushed through a spray ball back into the tank.

1. Attach an elbow fitting to the bottom valve of the tank to be cleaned. The elbow should point downwards.
2. Place a short-sided 3-gallon bucket beneath the elbow.
3. Attach a 1 inch suction hose to the inlet side of the pump and attach a valve or T (to weigh the end down when it is placed in the bucket) on the other end of the hose. The other end of the hose will be placed in the 3 gal bucket, with the end raised about two inches above the bottom of the bucket, deep enough to avoid sucking-up air, and not stick to the bottom of the bucket.
4. Attach a 1 inch discharge hose to the outlet of the air pump.
5. Attach a spray ball to the other end of the 1 inch discharge hose using the proper fittings. The spray ball is placed inside the tank a few inches bellow the top opening and the lid replaced as far as possible.

In the <u>264 gal variable volume tanks</u>, the hose fitting does not fit through the opening in the removable lid. In this case, attachand elbow and sufficient quick release *fittings to the 1inch hose to pass through the small opening in the lid of the variable volume tanks. Then balance the lid over the edge of the top of the tank and pass the quick release fittings on the end of the hose through the small hole in the lid and then attach the spray ball to the fittings so that the spray ball is now adjacent to the interior side of the lid.. The cover is placed into the tank, and the gasket is inflated to secure the cover near the top of the tank.*

6. Connect the air inlet on the pump to the compressed air supply using the orange air line.
7. Open the compressed air valve at the wall

V Cleaning procedure for a three-cycle wash

8. Remove any large debris with a broom or squeegee
9. Using a spray nozzle with hot water, spray down the inside wall of the tank. Spray both, through the top opening, and the pomace manway. Let the water drain through the open bottom valve, out onto the floor.
10. Use a brush to scrub off any accessible deposits not removed earlier.
11. When the interior is visibly clean, close and seal the pomace manway in preparation for the next step.
12. Place a 3-gallon bucket under the elbow attached to the tank, and fill the bucket with water.

Priming the pump and setting up the circulation

13. Prime the pump by lifting up the 1 inch suction line attached to the pump inlet and fill the line with water (this prevents air bubbles in the line during pumping) and close the valve:
14. Immerse the valve in the water in the bucket.
15. Simultaneously open the valve immersed in the bucket and switch on the pump to a medium speed.
16. Keep filling the bucket with water, until the water starts running out of the bottom valve of the tank the tank
17. *(Should air bubbles persist in the line, raise the line, higher than the pump, to push the bubbles upwards. Repeat as needed, until all persistent bubbles disappear.)*
18. Turn off the water. Adjust the butterfly valve until the water coming from the tank into the bucket equals the water being sucked up by the pump i.e. the water in the bucket remains at a constant level.
19. Check the complete circuit of lines, pump, and tank for leaks. Repair leaks if any.
20. Turn off the pump, and close the butterfly valve.
21. **Adding and using cleaning / sanitizing Agents**
22. Put 2 cups (1 cup = 250ml / 8oz) of soda ash into the bucket and **<u>stir until thoroughly dissolved</u>**.
23. Turn on the pump, adjust the valve as above and let the water cycle through for 15 minutes.
24. Remove the bucket from under the elbow, tipping the soda ash solution onto the floor being careful not to splash anyone.
25. Disconnect discharge hose from pump outlet and attach a water hose to it using a <u>tri-clamp / ¾"male quick release converter</u>. Switch on water and rinse tank with fresh water for 3 minutes.

26. Turn off water and reconnect the wine hose to the pump outlet.
27. Place a bucket with clean water under the elbow. Turn on pump and refill circuit with water as before.
28. Turn off pump when the bucket is full of water and the level is being maintained constant. Put 2 cups (1 cup = 250ml / 8oz). of citric acid and 12 g of KMBS in the bucket **and stir to dissolve**.
29. Switch on the pump to re-activate the circuit and let it run for 15 minutes.
30. Remove the bucket and let the circulating acidified SO_2 solution drain out.
31. Set up the water rinse as before ad run for about 5mins.
32. Start tasting the water as it exits the tank and when it is clean (i.e. no acid), the tank is now clean.
33. Empty all lines, and proceed to the wine processing step.

Napa Valley College, Viticulture and Winery Technology
Standard Operating Procedure

Assessing Grape Maturation

Developed by Joshua Lowell
December 2001

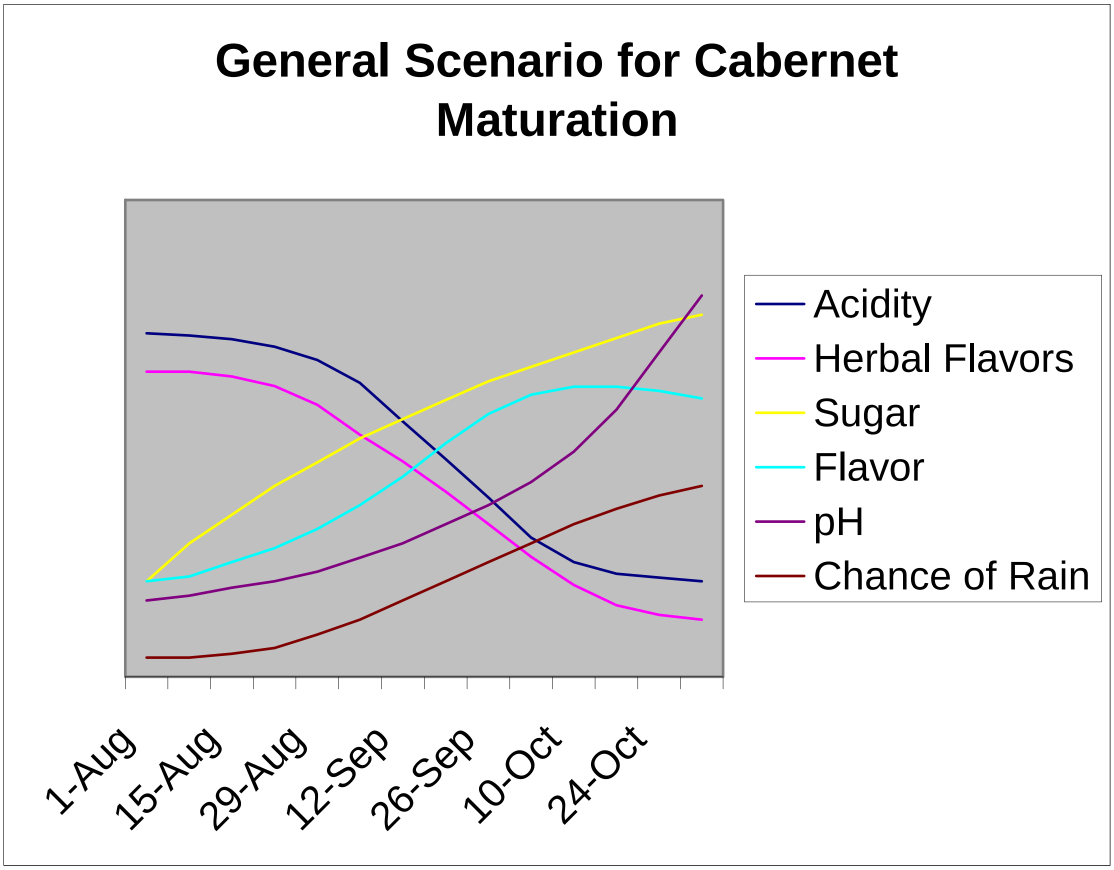
I INTRODUCTION:
Great wine is made from great grapes, but even great grapes are useless to the winemaker if they are not picked at the proper time. Assessing grape maturation is the key to determining the proper time. The winemaker must sample the grapes and decide on a style of wine to be made from them. Then, they must track certain indicators to determine when the grapes have reached a maturity suitable for their style. The indicators used are both qualitative (taste, smell…) and quantitative (pH, TA, °Brix…) [Appendices A. & C.] These indicators may also be compared to vineyard records (degree-days, date of veraison…) to identify trends to help predict vintage outcomes and identify the vineyard practices that play a major role in improving quality. [Appendices D. & E.]

I EQUIPMENT:
Zip-lock bags, grape knife or clippers, and ice chest (if unable to test immediately.)

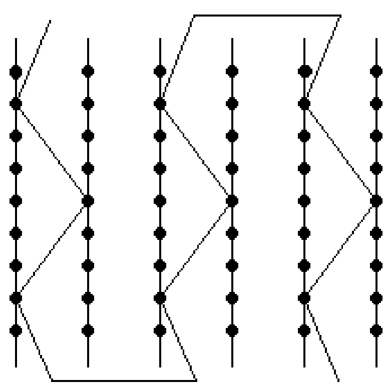
II PREPARATION:
Tracking indicators of grape maturity is accomplished through berry sampling.
<u>Sampling Strategy</u>: The samples should represent the entire vineyard as closely and with as much consistency as possible. Grape qualities can vary drastically depending on vine location in the vineyard, bunch location on the vine, and position on the bunch. Therefore, how one collects their sample can greatly affect the perceived maturity of the whole vineyard. As well, samples should be taken at the same time of day because grapes are subject to circadian patterns.
<u>Sampling Frequency</u>: Samples should be taken approximately once a week and with more frequency as the grapes mature. Extra vigilance should also be taken during climatic changes or inclement weather, as they can have dramatic effect on grape maturity and health.
<u>Analyses and Observations</u>: All indicators obtained through sampling should be recorded on a worksheet to track maturation through the growing season. [Appendix C.]

IV. PROCEDURE:
1. Collect a sample of approximately 200 berries.
2. Berries should be collected as whole as possible.
3. Zigzag between the rows, covering the whole vineyard. [Appendix B.]
4. Pick from different heights on the vine and from different areas on the cluster.
5. Record observations 1-12 on worksheet.
6. Keep berries whole and cool until testing is done.
7. For testing, gently mash berries in the bag and then strain for juice.
8. Hold some whole berries and juice aside for tasting and smelling.
9. Carry out analyses (15-18) as outlined in Analytical Procedures Manual.
10. Record observations 13 and 14.
11. Compare results with criteria required for wine style.

Appendix A.



Appendix B. BERRY SAMPLING PATTERN EXAMPLE

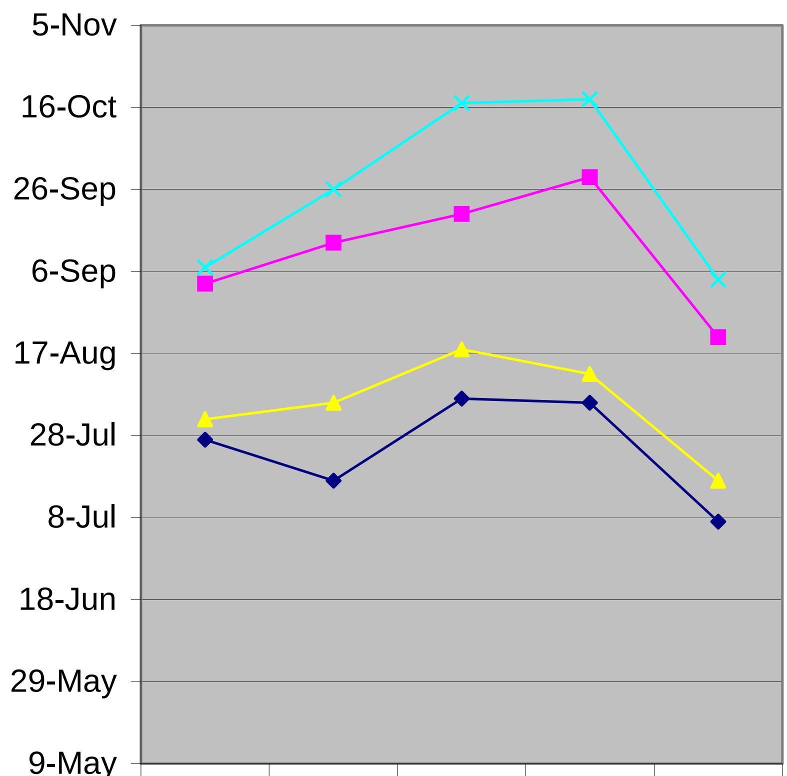


Appendix C. MATURATION WORKSHEET

Vineyard and grape observations and analyses	Dates
1. Days since veraison	
2. Degree of bird damage (no, low, high) Where?	
3. Degree of insect damage (no, low, high) Where?	
4. Degree of bunch rot & mildew (no, low, high) Where?	
5. Degree of Sunburn (no, low, high) Where?	
6. Canopy condition (thick, thin) Where?	
7. Early maturity in parts of the vineyard (East, West, Rows…)	
8. Stem color (green, yellow, brown)	
9. Seed color (red, green, yellow, brown)	
10. Skin texture in mouth (soft, chewy, crunchy)	
11. Skin color extraction (easy, difficult)	
12. Tannic taste of skins (low, medium, high, dry, harsh)	
13. Juice smell	
14. Juice taste	
15. °Brix	
16. pH	
17. Titratable Acidity	
18. °Brix-Acid Ratio	

Appendix D.

Starting Dates for Veraison and Picking of Napa Valley Chadonnay and Cabernet*

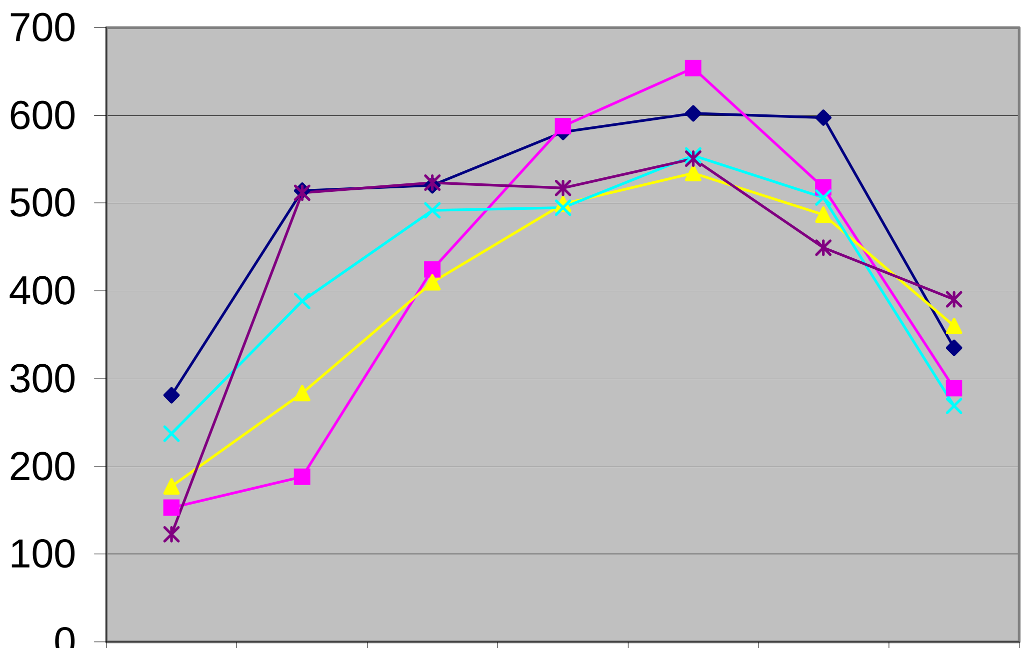


	2001	2000	1999	1998	1997
Char. Veraison	27-Jul	17-Jul	6-Aug	5-Aug	7-Jul
Char. Picking	3-Sep	13-Sep	20-Sep	29-Sep	21-Aug
Cab. Veraison	1-Aug	5-Aug	18-Aug	12-Aug	17-Jul
Cab. Picking	7-Sep	26-Sep	17-Oct	18-Oct	4-Sep

*Dates provided by Napa Valley Vintners Association

Appendix E.

Monthly Sum of Degree-Days* for Oakville**



	April	May	June	July	Aug	Sept	Oct
1997	281	514	520.5	581	602	597.5	335
1998	153	188.5	424.5	587.5	654	518	289
1999	177	283.5	409.5	499	534.5	487	360
2000	237.5	388.5	491.5	495	554.5	506.5	269
2001	122.5	512	523.5	517	550.5	449.5	390.5

* Degree-days are calculated by subtracting 50°F from the average temp. of the day:

$$\frac{(\text{High Temperature} + \text{Low Temperature})}{2} - 50°F$$

** Fahrenheit temperatures taken from the Oakville CIMIS Station.

Napa Valley College, Viticulture and Winery Technology Department
Standard Operating Procedure

Pre-Harvest Operations

Developed by Brandy LaVoy, Anthony Guerrera and Judy Colberg
December 2003

I. Introduction

The Pre-Harvest Operations are the preventative maintenance steps that wineries must take in order to prevent things from going wrong during harvest, crush and winemaking. Before the grapes are harvested it is essential to thoroughly clean the winery in order to prevent contamination of the grapes, or must by any microorganism or other contaminant which may exist in the winery. Everything in the winery must be cleaned starting with the winery itself to any equipment that may come into contact with the grapes, juice, or must. The cleaning procedure is, in general terms, to physically clean the item removing any debris, then put it into an acid solution, rinse it with warm water, then put it into a basic solution then rinse it with warm water and then allow it to dry. The term winery should be understood to mean the entire building including the cellar.

The equipment that needs to be cleaned is included in an itemized list below along with the methods required. This is the appropriate stage to take an inventory of chemicals and check to make sure that they have not gone past their expiration date. At this time also take an inventory of the equipment and make sure that it is in good working order. Do not forget equipment in the 40' storage container outside of the winery. Any problems should be taken care of now so that they do not come up at the height of harvest (for instance: expired chemicals must be re-stocked and broken equipment must be repaired or replaced). These preventative maintenance steps should occur 2-3 weeks before harvest is expected to take place. This should be adequate time to complete the cleaning and to correct any problems. Depending on the size of the winery and the size of the crew this maintenance should take between 3-5 days to complete.

II. General Cleaning Equipment

Water source
Water hose with adjustable spray gun
½ Ton bins
Protective eyewear
Gloves
Scrubbing brushes
Bottle brushes
2 gallon hand sprayer for Quat
Tank Cleaning Equipment -
    Compressed air
Air pump
1 ½ inch suction hose
1 ½ inch discharge hose
Spray ball
Gasket between fittings
Elbow fitting
Bucket
Measuring cup
Adapter fitting

III. General Chemicals

Soda Ash
Citric Acid
Bio Quat

IV. Procedure

Following is a checklist of the winery equipment that needs to be cleaned in preparation for the harvest and crush. For specific instructions on each of the Sanitation Procedures, please refer to your Procedures Manual.

Immediately following the cleaning checklist is a list of chemicals that should be stocked and kept on hand. Finally, remember to check the 40' container outside of the winery building used for storage and pull any equipment forward that will be needed for harvest.

Equipment	3-Cycle Wash	Single Cycle with Quat	Overnight Caustic Alkali	409 & Hot Water
FYB's/ Lug boxes	X			
Buckets	X			
½ Ton Bins	X			
1 Ton Bins	X			
Trash Cans (10, 30 & 60 gal)	X			
Beer Kegs (15.5 gal)	X			
Milk Kegs (13.89 gal)	X			
Carboys (750 ml, 3 gal, 5 gal)	X			
Jugs (1 gal)	X			
Bottles (375 & 750 ml)	X			
Fittings	X			
Barrel Heat Exchanger	X			
Barrel Wands	X			
Pumps	X			
Hoses/Lines[1]	X			
Destemmer/Crusher[1]	X			
Moving-Head Press[1]	X			
Barrel Room -		X – Hot Water Wash		
Shelves		X		
All Wooden Materials		X		
Basket Presses (Bladder & Ratchet)		X		
Caps			X	
Bungs			X	
Airlocks			X	
Thieves			X	
Stainless Steel Table				X
Peg Boards				X
Sinks				X
Steel Tanks[2]	X			
Barrels[3] (Water ONLY)				

[1]*Connect pumps and hoses to cleaning solution bins to clean both hoses and equipment being cleaned.*
[2]*Refer to Tank Cleaning Procedure*
[3]*Refer to Barrels Procedure*

V. Chemical Inventory:

Chemical	Additional Quantity Needed
Phenolphthalein	
Sodium Hydroxide (NaOH)	
Distilled Water	
pH 7.0 Buffer Solution	
pH 4.0 Buffer Solution	
Citric Acid	
Soda Ash	
Chemo 40	
Sodium Hydroxide	
Bio Quat	
Potassium Metabisulfite (KMBS)	
Active Dry Yeast	
Tartaric Acid	
Malolactic Bacteria	
Enzymes	
Super Food/DAP	
Clinitest Kits	

Napa Valley College, Viticulture and Winery Technology
Standard Operating Procedure

Picking and Sorting Grapes Prior to Winemaking

Developed by Kari Flores and Mike Bielawski
December 2001

I INTRODUCTION

The winemaker, in conjunction with others, must decide on a harvest date based on wine objective, fruit maturity, and practicality. "Picking and sorting" is the process of removing the crop from the vineyard and delivering it to the winery at a designated level of quality for winemaking. At the Napa Valley College vineyard, harvest is done with minimal mechanization. A significant crew is necessary.

II EQUIPMENT

1. Picking bins, aka FYBs (1 per 35 lbs of crop)
2. Larger containers if sufficient bins are not available (e.g. trash cans)
3. Crew (average person can pick 30 to 50 lbs. per hour depending on crop quality)
4. Picking knives or pruning shears (one for each crew member)
5. Gloves (some may want to wear protective gloves)
6. Scale (sufficient to weigh a loaded bin)
7. Record keeping (e.g., clipboard, pencil, calculator, watch, etc.)
8. Transportation from/to the winery (pickup truck(s))

III PREPARATION

1. All bins and containers should be thoroughly washed and dried – triple washed, if necessary.
2. Knives and pruners should be sufficiently cleaned, sharpened, and oiled.
3. The scale should be calibrated and a tare-weight (weight when empty) determined for each type of FYB. Consider calibrating the scale to zero at the bin's tare-weight.
4. <u>Picking should be scheduled for cool weather and early morning.</u>
5. The crew should be briefed on the logistics including: date and location, parking for non-NVC vineyards; start and stop time expectations; meeting place, location of water and bathroom facilities; picking strategy (such as starting from the east working west, middle of row working toward the ends, etc.).
6. The crew should be well informed of the quality expectations relative to the current state of the crop.
7. Any specific roles should be assigned including: transportation of materials and crop to and from the winery, record keeper, and scale operator. Consider that not every one is suited to lifting 35+ lb. Bins.

IV PROCEDURE

Picking

1. Start the picking session with a review of strategy and examples of acceptable and unacceptable fruit should.
2. Cut the clusters from the vine such that minimal stem is included. Drop the cut clusters into the bin without breaking the grape skins. Slide the bin under the fruit zone with your feet.
3. Full bins must be carried to the scale for weighing. Consider combining bins to carry to the scale before they are over loaded and become difficult to slide with your feet.

Sorting

1. Sorting occurs primarily 'in the field', meaning that the picker will not place inferior fruit or MOG (material other than grape) in the bin. Diseased fruit and MOG must remain less than 1% of the harvest.
2. Diseases likely to be encountered include: mildew, botrytis, and infection resulting from bird damage. Symptoms can generally be easily seen but may exist on only a small portion of the cluster (including interior sections).
3. All efforts should be made to discard diseased or otherwise inferior fruit. However, higher quality standards will lengthen the time it takes to harvest and reduce total yield. If necessary to meet harvest targets, individual bunches can be separated into acceptable and unacceptable fruit.
4. Fruit that will upset the 'chemistry' of the harvest should be discarded. In particular, second harvest (i.e. immature small clusters originating after the first few nodes on the cane) and raisined (dehydrated) grapes should be avoided. Avoid green stems that are bitter and an indicator of immature fruit. Pickers should taste a berry now and then to calibrate their sense of ripeness.
5. Full bins should be given a quality control check at the scale to ensure consistently applied sorting standards in the field.

Weighing and transport

1. Full bins must be weighed and recorded then stacked in the pickup truck or poured into larger transportation containers – again, taking care not to squash or break skins.
2. When the harvest is complete, the crop must be transported to the winery and unloaded. This handoff must be coordinated with winery staff.
3. At all times, waiting bins of grapes should be kept in a cool and shaded place.

Record keeping

1. Total harvest weight must be kept as required by the TTB for any marketed product.
2. Other data should be kept to further the ability to plan for future harvests, including: actual start and stop times, number of crew, weight picked per person-hour, average weight picked per bin, average weight picked per acre or vine.
3. Consult the picking crew and winery staff to consider areas for process improvement. Document and communicate 'lessons-learned' appropriately.

Napa Valley College, Viticulture and Winery Technology
Standard Operating Procedure

Making Additions to Musts and Wines

Developed by Jack Hussey and Reese Wilson
December 2001

INTRODUCTION

Various compounds are added to wines at different times in order to improve the structure and balance (e.g. tartaric acid) and / or to prevent microbial spoilage and oxidation (e.g. sulfur dioxide).

SO_2 Additions to Juice and Must

I INTRODUCTION

Sulfur may be added to the must or juice at crush in order to minimize contamination by unwanted bacteria, indigenous yeasts or other undesirable microorganisms.

II EQUIPMENT

1. Scale
2. 100 ml (or larger) plastic beaker for weighing KMBS

III CHEMICALS

1. Potassium Metabisulfite (KMBS)

IV PREPARATION

Make sure scale is clean, especially the weighing surface

V PROCEDURE

1. Review work order and make note of parts per million (ppm) total SO_2 required.
2. Convert tons or pounds of fruit to gallons juice assuming 160 gal/ton
3. Using formula below, determine amount of potassium metabisulfite (KMBS) required for Gallons of Juice
4. Using 100 ml (or larger) plastic beaker, weigh out required amount of KMBS and dissolve in water or juice:
   - **a.** Option A: Pour into must or juice and stir gently
   - **b.** Option B: Put in sprayer and spray onto surface of must or juice

FORMULA

Grams KMBS = ppm total SO_2 required x gals x 3.785 x 2/1000

= ppm required x gals x 0.00757

Must/Juice Volume in Gallons	**Amount of KMBS in Grams to Add to Achieve 1- 50 ppm total SO_2**							
	Note: Translate Pounds of Grapes to Gallons of Must or Juice assuming 160 gal/ton							
	1	**20**	**25**	**30**	**35**	**40**	**45**	**50**
1	**0.0075706**	0.15	0.19	0.23	0.26	0.30	0.34	0.38
2	0.015	0.30	0.38	0.45	0.53	0.61	0.68	0.76
3	0.023	0.45	0.57	0.68	0.79	0.91	1.02	1.14
4	0.030	0.61	0.76	0.91	1.06	1.21	1.36	1.51
5	0.038	0.76	0.95	1.14	1.32	1.51	1.70	1.89
10	0.076	1.51	1.89	2.27	2.65	3.03	3.41	3.79
20	0.151	3.03	3.79	4.54	5.30	6.06	6.81	7.57
30	0.227	4.54	5.68	6.81	7.95	9.08	10.22	11.36
40	0.303	6.06	7.57	9.08	10.60	12.11	13.63	15.14
50	0.379	7.57	9.46	11.36	13.25	15.14	17.03	18.93
100	0.757	15.14	18.93	22.71	26.50	30.28	34.07	37.85
150	1.136	22.71	28.39	34.07	39.75	45.42	51.10	56.78
200	1.514	30.28	37.85	45.42	52.99	60.56	68.14	75.71
300	2.271	45.42	56.78	68.14	79.49	90.85	102.20	113.56
400	3.028	60.56	75.71	90.85	105.99	121.13	136.27	151.41
500	3.785	75.71	94.63	113.56	132.49	151.41	170.34	189.27
1,000	7.571	151.41	189.27	227.12	264.97	302.82	340.68	378.53
2,000	15.141	302.82	378.53	454.24	529.94	605.65	681.35	757.06

Rehydration of Yeast for Fermentation

I INTRODUCTION

Yeast is often added to must or juice to help achieve style objectives and/or achieve a complete fermentation to dryness.

II EQUIPMENT

1. Weighing Scale
2. 100 ml (or larger) plastic beaker for weighing yeast
3. 1 L (or larger) beaker for preparing yeast
4. Alcohol thermometer (not mercury)

1 L (or larger) beaker for juice to add to Yeast preparation

III MATERIALS

1. Active Dry Yeast
2. Hot and cold tap water
3. Juice from grapes to be inoculated

IV PROCEDURE

1. Make note of type and amount of Yeast in Pounds per 1000 gallons
2. Using Table below, determine amount of Yeast and Water required for Gallons of Must to be inoculated
3. Convert tons or pounds of fruit to gallons juice assuming 160 gal/ton
4. Using 100 ml plastic beaker, weigh out required amount of Yeast
5. Add hot and cold tap water to 1 L beaker in the amount from table to yield a temperature of ~ 100 ^{o}F or as stated on the packet.
6. Sprinkle Yeast on surface of water; when Yeast has sunk, stir gently with finger or hand and get rid of any lumps
7. Wait 15 minutes
8. Measure the temperature of the rehydatrated yeast and then pour in juice until the temperature has dropped by 18^{o}F. Wait 15mins
9. Repeat step 8 until the Yeast preparation is within 18^{o}F of desired temperature for the beginning of fermentation

8. Carefully add the reydrated yeast to must or juice and:
   a. for Whites, don't stir
   b. for Reds, gently punch down until Yeast just disappears from sight

FORMULA

Grams of yeast required = (rate of addition x gals must / juice x 454)/1000

Must Volume in Gallons	Amount of Yeast in Grams to Add to for Selected Must Volumes and Pounds Yeast per 1000 Gallons Ratios (plus Water in ml)					
	1.0 #/Kgal	**Water (ml)**	**1.5 #/kgal**	**Water (ml)**	**2.0 #/kgal**	**Water (ml)**
1	**0.454**	100	0.680	100	0.907	100
3	1.36	100	2.04	100	2.72	100
5	2.27	100	3.40	100	4.54	100
10	4.54	100	6.80	200	9.07	200
15	6.80	200	10.21	200	13.61	400
20	9.07	200	13.61	400	18.14	400
30	13.61	400	20.41	400	27.22	800
40	18.14	400	27.22	800	36.29	800
50	22.68	800	34.02	800	45.36	800
60	27.22	800	40.82	800	54.43	1,200
120	54.43	1,200	81.65	1,200	108.86	1,600
180	81.65	1,200	122.47	1,600	163.29	2,000
240	108.86	1,600	163.29	2,000	217.72	2,000
300	136.08	1,600	204.12	2,000	272.16	2,400
360	163.29	2,000	244.94	2,400	326.59	2,800

Nutrient Additions

I INRODUCTION

Nutrients are often added to the must or juice just before inoculation with a yeast to help complete the fermentation process within a reasonable time frame for the chosen style.

II EQUIPMENT

1 Scale
2 Plastic baggie or other receptacle for weight measurement(s)
3 Beaker or other receptacle
4 Spoon

III MATERIALS

1 Nutrients (e.g., DAP, Superfood)

IV PROCEDURE

1 Make note of type and amount of Nutrient (e.g., 200ppm or 2 pounds per 1000 gallons) and volume of must (red wines) or juice (white wines) to which Nutrients will be added
2 Use the appropriate Table to calculate the grams of Nutrient required for specified rate of addition and volume of must/juice
3 Convert tons or pounds of fruit to gallons juice assuming 160 gal/ton
4 Make sure the scale is clean and in working order
5 Put a receptacle large enough to hold Nutrients on scale
6 Tare / Zero out the scale
7 Using a clean spoon or spatula, weigh out the Nutrient
8 Dissolve Nutrient thoroughly in a small amount of must or juice (e.g., 500 ml for a 5-10 gal total volume
9 Stir into Must or Juice

FORMULA

When rate of addition is expressed as lbs / 1000gal (Use Table 1)

Grams nutrient required = #/kgal x gal x 454/1000
= #/kgal x gal x 0.454

When rate of addition is expressed as ppm or mg/L (Use Table 2)

Grams nutrient required = ppm x gal x 3.785/1000 [ppm is equal to mg/L]
= ppm x gal x **0.003785**

Table 1. Making additions as pounds per 1000 gallons (#/ 1000gal or #/ kgal)

Fermentation Volume in Gallons	**Amount of Nutrients in *Grams* to Add to for Selected Pounds per 1000 Gallons Targets and Volumes Must/Juice in Gallons**						
	0.5 #/1000	**0.75 #/1000**	**1.0 #/1000**	**1.25 #/1000**	**1.5 #/1000**	**1.75 #/1000**	**2.0 #/1000**
1	0.23	0.34	**0.454**	0.57	0.68	0.79	0.91
2	0.45	0.68	0.91	1.13	1.36	1.59	1.81
3	0.68	1.02	1.36	1.70	2.04	2.38	2.72
4	0.91	1.36	1.81	2.27	2.72	3.18	3.63
5	1.13	1.70	2.27	2.83	3.40	3.97	4.54
10	2.27	3.40	4.54	5.67	6.80	7.94	9.07
15	3.40	5.10	6.80	8.50	10.21	11.91	13.61
20	4.54	6.80	9.07	11.34	13.61	15.88	18.14
25	5.67	8.50	11.34	14.17	17.01	19.84	22.68
30	6.80	10.21	13.61	17.01	20.41	23.81	27.22
35	7.94	11.91	15.88	19.84	23.81	27.78	31.75
40	9.07	13.61	18.14	22.68	27.22	31.75	36.29
45	10.21	15.31	20.41	25.51	30.62	35.72	40.82
50	11.34	17.01	22.68	28.35	34.02	39.69	45.36
55	12.47	18.71	24.95	31.18	37.42	43.66	49.90
60	13.61	20.41	27.22	34.02	40.82	47.63	54.43

Table 2. Making additions as parts per million (ppm) or milligrams per liter (mg/L)

Must/Juice Volume in Gallons	**Amount of Nutrients in Grams to Add to Achieve 1- 50 ppm**							
	1	**20**	**25**	**30**	**35**	**40**	**45**	**50**
1	**0.003785**	0.08	0.10	0.12	0.13	0.15	0.17	0.19
2	0.01	0.15	0.19	0.23	0.27	0.31	0.34	0.38
3	0.01	0.23	0.29	0.34	0.40	0.46	0.51	0.57
4	0.02	0.31	0.38	0.46	0.53	0.61	0.68	0.76
5	0.02	0.38	0.48	0.57	0.66	0.76	0.85	0.95
10	0.04	0.76	0.95	1.14	1.33	1.52	1.71	1.90
20	0.08	1.52	1.90	2.27	2.65	3.03	3.41	3.79
30	0.11	2.27	2.84	3.41	3.98	4.54	5.11	5.68
40	0.15	3.03	3.79	4.54	5.30	6.06	6.82	7.57
50	0.19	3.79	4.73	5.68	6.63	7.57	8.52	9.47
100	0.38	7.57	9.47	11.36	13.25	15.14	17.04	18.93
150	0.57	11.36	14.20	17.04	19.88	22.71	25.55	28.39
200	0.76	15.14	18.93	22.71	26.50	30.28	34.07	37.86
300	1.14	22.71	28.39	34.07	39.75	45.43	51.10	56.78
400	1.51	30.28	37.86	45.43	53.00	60.57	68.14	75.71
500	1.89	37.86	47.32	56.78	66.25	75.71	85.17	94.64
1,000	3.79	75.71	94.64	113.56	132.49	151.41	170.34	189.27
2,000	7.57	151.41	189.27	227.12	264.97	302.83	340.68	378.53

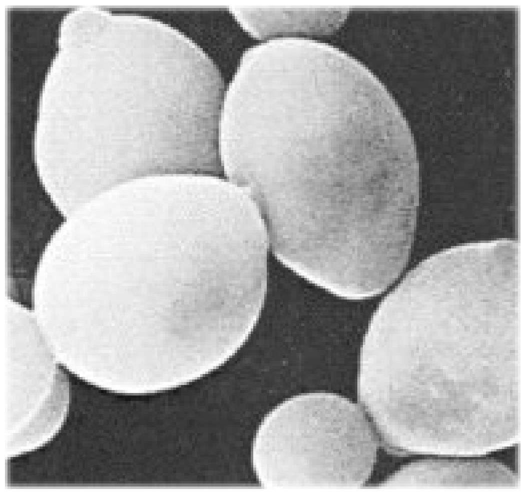
Napa Valley College, Viticulture and Winery Technology
Standard Operating Procedure

Nitrogen additions

Developed and Designed by Kiki Lee and Jean-Claude Pijanowski
December 2003

I. Introduction

Analyzing and regulating nitrogen is critical to the survival of yeast cells.



(Yeast – electron microscope)

. . . . Alive, It's Alive!!, It's ALIVE!!!!!
(Gene Wilder - Young Frankenstein – The Movie 1974)

Yes, yeast is a living single cell fungi and requires various nutrients for survival. Yeast cells contain many of the same organelles as a multicellular plant or animal. They also contain a nucleus with chromosomes and propagate through exponential cell growth budding. Yeast cells may become stressed through nutrient deficiency and inappropriate fermentation temperatures.

Yeast first consumes the ammonium nitrogen (NH4+) and free amino acids in the must with the exception of proline. These components together constitute the total "Yeast Available Nitrogen" (YAN). YAN promotes the synthesis of proteins, which are essential to yeast activity. Nitrogen also is used during the growth and formation of cell walls within the yeast.

Too low a concentration of fermentable Nitrogen can cause a sluggish, protracted fermentation, and may contribute to the production of volatile sulfur compounds. The principle factor influencing the production of desirable fermentation volatiles is the nitrogen source for the yeast.

Too much nitrogen can cause the fermentation to occur too quickly resulting in the loss of desirable volatile components and increased production of both volatile sulfur compounds and ethyl carbamate (can be carcinogenic).

II. Procedure

In order to decide whether any nitrogen needs adding to a must, we need to measure the brix and YAN (either by the Formol method, or a combination of an ammonia method and the NOPA amino acid analysis). Here, we shall use the Formol method.

STEP 1 **- *Recognize the*** *three* ***elements required for the addition of nitrogen.***

a. A Brix value of the juice BEFORE inoculation.

BRIX value represents the percentage of sugar in the juice and can be measured with a refractometer or hydrometer (see lab manual). Accurate measurements are essential for determining nutrient additions and should be recorded diligently.

b. An analysis of YAN in the must through the use of the FORMOL METHOD.

FORMOL METHOD is the analysis performed on grape berry samples prior to harvest. The analysis produces a number expressed as YAN (see lab manual)

c. Adding the appropriate type and amounts of nitrogen at different stages of fermentation.

ADDING NUTRIENTS is the physical act of the preparing and adding of compounds to the juice (must). Nutrient preparation is explained in detail elsewhere in the procedures manual. Below is a list of nitrogen sources that may be used at different amounts and stages during fermentation.

Commercial Nitrogen Supplements:

Supplement	Nitrogen source as a % of total YAN in the supplement	YAN as a % of the total wt. of the supplement	mg/L of YAN added when supplement is added at ~1#/kgal
DAP	**NH4 (100)**	**21.7**	**27**
Fermaid K	**Amino (?), NH4 (?)**	**10.0**	**12.5**
Superfood	**Amino (33-44), NH4 (67-56)**	**7.4**	**9**
Actiferm 1	**Amino (3.7), NH4 (96.7)**	**13.5**	**17**
Actiferm 2	**Amino (6.9), NH4 (93.1)**	**14.5**	**18**
Go Ferm	**Amino (100)**	**3.3**	**4.1**

STEP 2 – At this step two values are required in order to proceed.

BRIX (hydrometer/refractormeter) & **YAN** (Formol Method lab analysis)

There are three tables listed below (**A, B**, & **C**) with different Brix ranges. Use your brix value and find which table applies to your sample. Next, on the far left of the table is the YAN value. Match the YAN number of your sample to the corresponding number range

***Example*:** Your juice sample (grapes or must) has a Brix of 25.5 and a YAN of 162
***Solution*:** Use table **C** and with the low range additions (150-200):

Low 150-200	**2**	**2**	**1**	**1**	**6**	**718.8**

NITROGEN ADDITION PROTOCOLS:

Table - A - Brix 22 - 23 (even after dilution to <23 brix)

Juice YAN (mg/L)	Rehydration of water	End of Lag Phase	End of Lag Phase	1/3 sugar depletion	Total Supplement after rehydration	
	Go-Ferm (#/Kgal)	DAP (#/Kgal)	Supplement (#/Kgal)	Supplement (#/Kgal)	#/Kgal	ppm
high > 250	1	0	0	1	1	120
med (150-250)	1	0	1	1	2	240
low (100 -150)	2	1	1	1	3	360
v. low < 100	2.5	2	1	2	5	600

Table - B - Brix 23 - 25 (even after dilution to 24 brix)

Juice YAN (mg/L)	Rehydration of water	End of Lag Phase	End of Lag Phase	1/3 sugar depletion	Total Supplement after rehydration	
	Go-Ferm (#/Kgal)	DAP (#/Kgal)	Supplement (#/Kgal)	Supplement (#/Kgal)	#/Kgal	ppm
high >300	1	0	0	1	1	120
med (200-300)	1.5	0	1	1	2	240
low (125 -200)	2	1.5	1	1	3.5	4208
v. low < 125	2.5	2	1	2	5	600

Table - C - Brix 25 - 27 (even after dilution to 24 brix)

Juice YAN (mg/L)	Rehydratio n of water	End of Lag Phase	End of Lag Phase	1/3 sugar depletion	Total Supplement after rehydration	
	Go-Ferm (#/Kgal)	DAP (#/Kgal)	Supplement (#/Kgal)	Supplement (#/Kgal)	#/Kgal	ppm
high > 350	1	0	0	1	1	120
med (250-350)	1.5	0	1	1	2	240
low (150-250)	2	2	1	1	4	480
v. low < 150	2.5	2	1	2	5	600

STEP 3 – Time to physically prepare additions and mix with the juice must.

There are three stages within table **A**, **B**, & **C** in which nitrogen is added. These phases are the “Rehydration of water”**,** **“**the End of Lag“ and “1/3 Sugar depletion”.

Rehydration of water: FIRST STAGE

This is the first nitrogen addition (Go-Ferm) and is added with the yeast at the moment of rehydration (see separate procedure).

End of Lag phase: SECOND STAGE

This stage occurs during initial active fermentation and is recognized when the **brix** has dropped **2-3 degrees**. Most nitrogen and ammonia is depleted and additions (e.g. DAP and Superfood) are added at this point in order for yeast to continue their growth cycle. Again, follow addition procedures described earlier.

1/3 Sugar depletion: THIRD STAGE

At this stage, nitrogen is needed to sustain cell budding and the alcohol is still low enough for yeast to uptake nitrogen. IT IS THE MOST IMPORTANT ADDITION. Example: Inoculation at 24 brix = 1/3 depletion at **16 brix**. Follow addition procedures and continue monitoring fermentation until completion.

STEP 4 - Remember, a successful fermentation cycle is paramount to creating wine.

The most important factor during fermentation is the survival of yeast and the complete conversion of sugars to ethanol. If there is one mantra to follow during this phase it is:

“Don’t’ stress the yeast!”

Quotes for winemakers :

"Good wine is a necessity of life for me." - Thomas Jefferson

"...good company, good wine, good welcome, can make good people."
- William Shakespeare

“Good wine is a necessity of life for me.” - Benjamin Franklin

“Wine is sunlight held together by water.” - Galileo

“Nothing more excellent or valuable than wine was ever granted by the Gods to man.”
- Plato

Tartaric Acid Additions to Musts and Wines

I INTRODUCTION

Tartaric acid can be added to musts and wine to lower its pH and raise its titratable acidity (TA). A rule of thumb states: addition of 1 gram tartaric acid per liter (equivalent t 8.2 # /1000 gal) decrease pH by 0.1 while raising TA by 1 g/L.
Tartaric acid is usually added to lower pH and thus reduce the potential of adverse microbial activity and/or to increase acid and reduce or mitigate flabbiness in the mouth.

II EQUIPMENT

1. Scale
2. Container for tartaric acid solution
3. Beaker for 500 ml wine sample
4. 5 or 10 ml pipette
5. 100 ml graduated cylinder
6. Five wine glasses

III CHEMICALS

1. Tartaric acid

IV PROCEDURE

1 Assess the amount to add

During the early stages of winemaking, acid is usually added in order to minimize microbial infection. This is achieved by keeping the pH below 3.7-3.8 for reds and below 3.6 for whites. Alternatively, trials during previous vintages with the same grapes and wine style will have indicated a suitable level for both parameters. As the winemaking process proceeds, it becomes more important to conduct taste trials before making any acid additions.

a Based on pH and TA Analysis

Use the rule of thumb, that 1g/L or 8.2# / 1000gal decreases the pH by 0.1 units and increases the TA by 1g/L.

b Based on an Acid Trial

1. Make a 100 g/L aqueous solution by dissolving 10 grams of tartaric acid in 100 ml of distilled water (or 25 grams in 250 ml water, etc.).
2. Set up 5 wine glasses and mark them as Control, 0.25g/L, 0.5 g/L, 0.75 g/L, and 1 g/L.
3. Using a pipette, put:
   a. 0.25ml into the 0.25g/L glass
   b. 0.5 ml of solution into the 0.5 g/L glass

- **c.** 0.75 ml in the 0.75 g/L glass
- **d.** 1 ml in the 1 g/L glass.

4. Draw 500 ml (or slightly more) wine, put it in a beaker, and using a graduated cylinder put 100 ml of wine into each of the five (5) wine glasses; stir.

5. Taste the control and each of the four trials and record aroma, flavor, structure, balance & finish, and other sensory attributes important to the style of wine being made.

6. Select the acid addition that reflects the wine style.

7. Add less rather than more tartaric acid, e.g., if 2 g/L if selected as "optimal" add 1 g/L (can add more later)

8. If it is a toss-up between two, say 0.75 and 1 g/L, redo the trials for control, 0.70, 0.80, 0.90 & 1.0 g/L

9. Once a decision has been made on the amount to add, measure and record the pH & TA of the must / wine with the chosen level.

2 Making the Addition

a Having established the concentration to add, calculate the weight of tartaric acid to be added to the volume of must or wine using the formula below

b Convert tons or pounds of fruit to gallons juice assuming 160 gal/ton

c Using 100 ml (or larger) plastic beaker, weigh out required amount of Tartaric acid and dissolve thoroughly in water, juice, or wine:

d Pour into must, juice or wine and stir gently

FORMULA

Grams Tartaric acid required = g/L required x gals x 3.785
Lbs Tartaric acid required = g/ l required x gals x 3.785 / 454

Napa Valley College, Viticulture and Winery Technology
Standard Operating Procedure

SO_2 Additions to wines

Developed by Gerry Ritchie
December 2001

I INTRODUCTION

Sulfur dioxide (SO_2) is added to minimize growth of undesirable microorganisms and enzymes and to help minimize oxidation. SO_2 additions are either made on a regular basis (e.g. every 1-3 months) or after a particular stage or operation.

It can be added as a gas, a solution or by using potassium metabisulfite (KMBS). We shall either use a solution (called a stock solution) or dissolve KMBS in some wine and then add it to the wine.

SO2 Additions are made after:

- MLF
- Racking
- Moving
- Topping
- Acidity adjustment
- Filtration
- Fining or Stabilization
- Before Bottling

I CHEMICALS

a Potassium Metabisulfite (KMBS)

II EQUIPMENT

i Gas mask (if you are sensitive to SO_2)
ii pH meter if pH is not known
iii equipment for measuring free SO_2 (FS)

Adding KMBS to wines

i Weighing Scale
ii 100 ml plastic beaker for weighing KMBS
iii 1 liter plastic beaker for wine
iv stirring equipment for wine in beaker and wine in container being adjusted

Adding stock solution to wines (see end of procedure for making stock solutions)

i 10, 50 or 100ml measuring cylinder
ii Stirring equipment

1. PREPARATION

a Assemble equipment
b Make sure the weighing surface of the scale is clean.
c Measure pH if necessary (see lab manual)
d Measure FS if necessary (see lab manual)

2. PROCEDURE

There are four stages to making an SO_2 addition. We have to

i *Assess whether the add is an initial or a subsequent addition*:
Note the stage of the winemaking process and the winemaking plan
Initial (i.e. after AF or MLF, depending on the plan)
Subsequent (i.e. additions made, after the initial add, at regular intervals in order to maintain the FS at an adequate level to minimize contamination of the wine)

ii *Decide the form of the SO_2 that we are going to add*:
Stock solution or KMBS

iii Estimate how much to add
It depends on whether the pH is above or below pH3.55, how much free SO_2 (FS) is already present (if any) and the amount of bound SO_2
It is critical to get someone to check your calculations as mistakes are difficult to rectify without decreasing the quality of the wine

iv *Make the addition*.
It is critical to dissolve all the KMBS thoroughly before adding to the bulk of the wine
It is critical to thoroughly mix it into the bulk of the wine

In the NVC winery we mainly use KMBS

3. ESTIMATING HOW MUCH TO ADD

a. Estimating Initial SO2 Additions

Using KMBS (i.e. When you do not have many barrels or small containers)

1. **If pH is < 3.55**, add sufficient to achieve 0.5mg/L molecular SO_2 (see Fig. 1) plus an estimate to correct for bound SO_2 (see Table 1). Follow procedure given under section **Vb** and in step 2, assume free SO_2 (FS) = 0.

   A common starting point is to add 40-50ppm.

2. **If pH is > 3.55**, add sufficient to achieve FS of 30ppm after correcting for bound SO_2 (see Table 1). Follow procedure given under section **Vb** and assume FS = 0.

   A common starting point is to add 50-60ppm.

Using a stock solution (i.e. When you have plenty of volume / barrels or containers)

1. Add increasing amounts of a 5.58 or 7.5% SO_2 stock solution to each of 3 barrels (e.g. 110ml, 140ml, 160ml)
2. Stir without disturbing lees, sample and analyze for Free SO2
3. Repeat process until addition hits target FS
4. For all the other barrels, use the addition rate that gives the target Free SO2

Table 1. Method for guestimating bound SO_2.

Stage	**Initial Guess at Fraction Bound**
Unsulfured wine / juice	0.25 – 1.0 Red > white
Previously sulfured wine	0.15 - 0.25
Microbially challenged wine	Greater than normal
Pre bottling	0.05 – 0.15 (should know the value by now)

b Estimating <u>Subsequent</u> SO2 Additions

Using KMBS

1. Measure pH (see Lab Analyses Manual)
2. Measure Free SO2 (see Lab Analyses Manual)
3. Estimate fraction bound (see Table 1 for guestimates)
4. <u>If pH is < 3.55</u>, decide on <u>target</u> molecular SO2 (0.5 or 0.8mg/L) and estimate corresponding free SO2 at pH of wine (see Fig. 1)
   <u>If pH > 3.55</u>, choose 30ppm as <u>target FS</u> if wine is healthy or 35ppm FS if wine has a high VA or there is a risk of contamination
5. Subtract <u>measured</u> Free SO2 from <u>target</u> free SO2 (Step 4 – Step 2)
6. Multiply amount in Step 5 by fraction bound decide upon in Step 3
7. Add the FS calculated from Step 5 to the bound value calculated in Step 6. This gives the <u>required</u> FS
8. Calculate amount to add as KMBS or use Table 2

Grams (g) of KMBS to add = ppm FS required x gals x 3.785 x 2/1000
= ppm FS required x gals x 0.00757

Using a stock solution

1. Carry out steps 1-7, as for using KMBS
2. Calculate amount to add as a 0.38, 5.58 or 7.5% SO_2 stock solution or use Table 3

mls of 0.38% solution to add = ppm FS required x gals x 3.785 x 100/(0.38*1000)
= ppm FS required x gals

mls of 5.58% solution to add = ppm FS required x gals x 3.785 x 100/(5.58*1000)
= ppm FS required x gals

mls of 7.5% solution to add = ppm FS required x gals x 3.785 x 100/(7.5*1000)
= ppm FS required x gals x 0.0505

Example:
Initial FS = 23ppm
pH = 3.6
Final FS desired = 30ppm
Fraction Bound = 0.20
Grams of KMBS / bbl = ((30 – 23) + (7 x 0.2)) x 2 x 59 x 3.785 / 1000
=3.75g / bbl

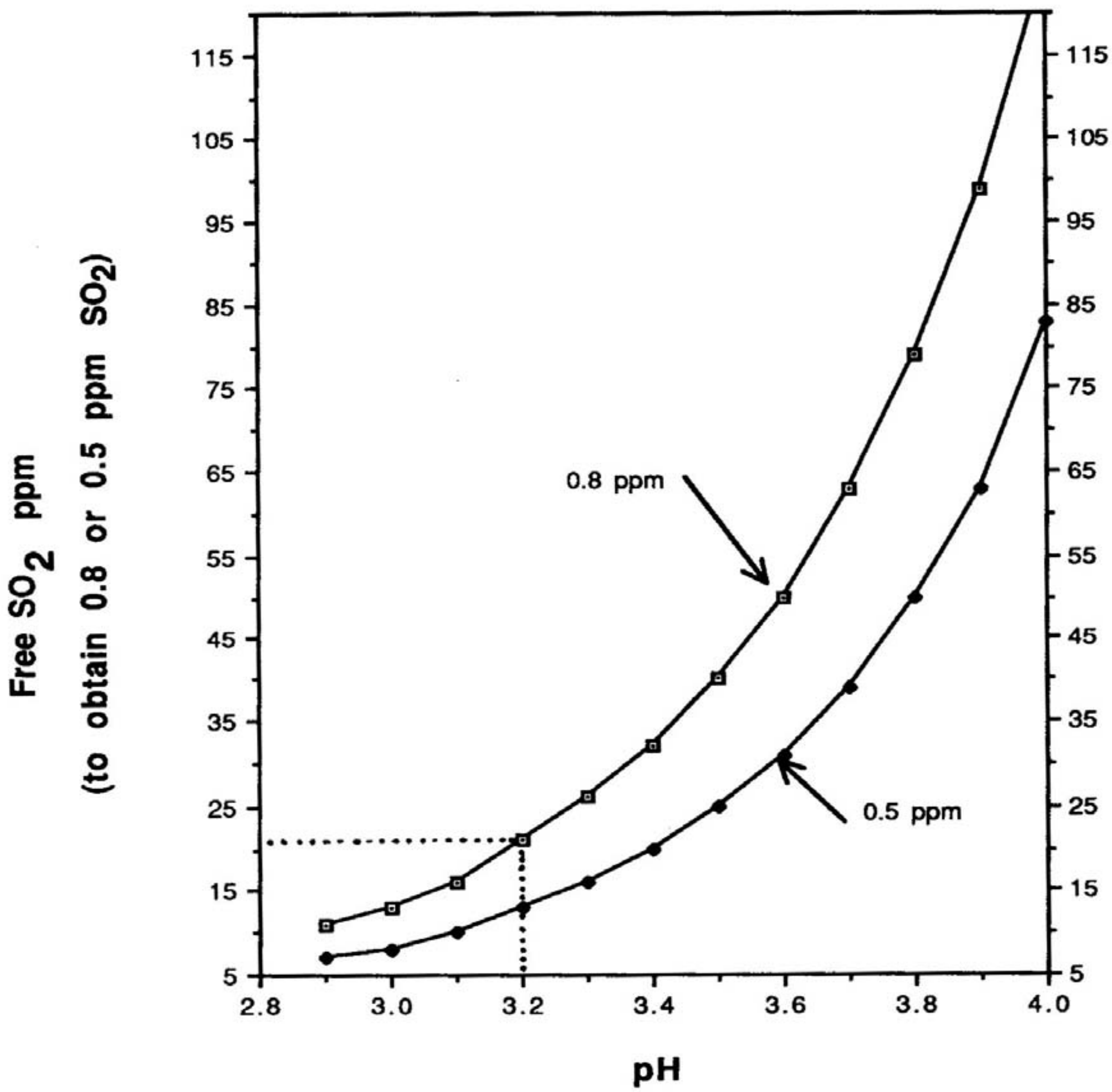


Fig. 1. The variation in Free SO_2 (FS) with pH for 0.5 and 0.8 molecular SO_2.

Table 2. Grams of KMBS required to raise the ppm of FS in different volumes of wine (the required FS in step 7 on p.60)

	Volume of Wine (gals)						
ppm FS required	1	2	3	5	15	50	59
1						0.38	0.45
2					0.23	0.76	0.89
3					0.34	1.14	1.34
4				0.15	0.45	1.51	1.79
5				0.19	0.57	1.89	2.23
6				0.23	0.68	2.27	2.68
7			0.16	0.26	0.79	2.65	3.13
8			0.18	0.30	0.91	3.03	3.57
9			0.20	0.34	1.02	3.41	4.02
10		0.15	0.23	0.38	1.14	3.79	4.47
11		0.17	0.25	0.42	1.25	4.16	4.91
12		0.18	0.27	0.45	1.36	4.54	5.36
13		0.20	0.30	0.49	1.48	4.92	5.81
14		0.21	0.32	0.53	1.59	5.30	6.25
15		0.23	0.34	0.57	1.70	5.68	6.70
16		0.24	0.36	0.61	1.82	6.06	7.15
17		0.26	0.39	0.64	1.93	6.43	7.59
18		0.27	0.41	0.68	2.04	6.81	8.04
19		0.29	0.43	0.72	2.16	7.19	8.49
20	0.15	0.30	0.45	0.76	2.27	7.57	8.93
25	0.19	0.38	0.57	0.95	2.84	9.46	11.17
30	0.23	0.45	0.68	1.14	3.41	11.36	13.40
35	0.26	0.53	0.79	1.32	3.97	13.25	15.63

Table 3. Mls of 0.38, 5.0, 7.5 & 10% SO_2 Stock Solutions required to raise the ppm of FS in barrels & smaller containers

ppm FS required	mls of 5-10% Stock Solution per Barrel			mls of 0.38% SO2 solution for 1-5gals wine			
	5%	**5.58%**	**7.5%**	**1gal**	**2gals**	**3gals**	**5gals**
1	4.47	4	2.98	1	2	3	5
2	9.00	8	6.00	2	4	6	10
3	14.00	12	9.00	3	6	9	15
4	18.00	16	12.00	4	8	12	20
5	23.00	20	15.00	5	10	15	25
6	27.00	24	18.00	6	12	18	30
7	32.00	28	21.00	7	14	21	35
8	36.00	32	24.00	8	16	24	40
9	41.00	36	27.00	9	18	27	45
10	45.00	40	30.00	10	20	30	50
11	50.00	44	33.00	11	22	33	55
12	54.00	48	36.00	12	24	36	60
13	59.00	52	39.00	13	26	39	65
14	63.00	56	42.00	14	28	42	70
15	67.00	60	45.00	15	30	45	75
16	72.00	64	48.00	16	32	48	80
17	76.00	68	51.00	17	34	51	85
18	81.00	72	54.00	18	36	54	90
19	85.00	76	57.00	19	38	57	95
20	90.00	80	60.00	20	40	60	100

MAKING THE ADDITION

Using KMBS
Weigh out required amount of KMBS into a 100 ml (or larger) plastic beaker

1. Dissolve the KMBS completely in some of the wine (~500mls) in a 1L plastic beaker, using a magnetic stirrer if necessary

OR

Using a stock solution
Measure out the required volume of stock solution in a 100ml (or less) measuring cylinder

2. Add to wine and stir gently but thoroughly
3. Re-check Free SO2
4. Repeat process until desired concentration (ppm) of FS is achieved

Preparation of Stock Solution

Equipment

- i Weighing Scale
- ii 100 ml plastic beaker for weighing KMBS
- iii Funnel
- iv Volumetric Flask
- v Magnetic Stirrer and stirring bar
- vi Plastic container for holding Stock Solution

1. Decide the strength of the SO_2 solution and how much stock solution will be required in order to complete the task. Use Table 4 to determine the weight of KMBS required for the chosen volume and strength of stock solution.
2. Weigh out required amount of KMBS into a 100 ml (or larger) plastic beaker
3. Using a dry funnel, quantitatively transfer to a dry volumetric flask, (which has a volume equivalent to the value decided upon in step 1)
4. Add some water (approximately ¾ of the final volume) and stir with a magnetic stirrer until all, or nearly all, has dissolved
5. Remove stirring bar and top up to the mark with water
6. Invert flask 20 times to thoroughly mix the contents
7. Decant into plastic container and label (include date of preparation)

Table 4. Grams KMBS required to make stock solutions of 0.38 -7.5% SO_2

Final volume (mls) of Stock Solution	% SO2 in Stock Solution			
	5	**5.58**	**7.5**	**0.38**
100	10	11.16	15	0.76
500	50	55.8	75	3.8
1000	100	111.6	150	7.6

Napa Valley College, Viticulture and Winery Technology
Standard Operating Procedure

Enzymes Additions

Developed by Bobbie Curley
December 2003

Introduction

Enzymes are naturally present in fruit and wine. Enzyme additions are made to facilitate and increase the rate of some chemical reactions in the must or in the wine. Some examples of desired chemical reactions from the use of enzymes are as follows:

- Preserving freshness and aroma of the grapes
- Extraction of phenolic compounds (including color) and flavors
- Settling of must and lees prior to fermentation
- Releasing juice to improve the press yield
- Fining, clarifying and filterability

<u>Equipment</u>

- Thermometer
- Beaker
- Stirrer

<u>Preparation of Liquid Enzymes</u>

<u>(Read manufacturer's preparation instructions on the enzyme product package.)</u>

Make an approximate 10% solution in cool water (21 – 25 C or 70 – 77 F).

<u>Preparation of Powdered/Granular Enzymes</u>

<u>(Read manufacturer's preparation instructions on the enzyme product package.)</u>

Add cool water (21 – 25 C/70 – 77 F) to the enzyme to create a paste. Then, add more cool water to dissolve completely.

Procedure – <u>Proceed depending on the need:</u>

Sprinkle the solution over the crushed grapes, before fermentation;

OR

Add to the tank and gently stir to disperse the enzyme solution;

OR

Gently mix the solution into the wine tank, after fermentation.

Napa Valley College, Viticulture and Winery Technology
Standard Operating Procedure

Tannin Additions

Developed by Robert Davis
December 2003

I Introduction

HISTORY

FRANCE- French winemakers have been adding tannins well before 1955 to correct a deficiency in a difficult vintage, to fix color and to provide grip. Tannin isn't used to hide anything, but to reveal the quality of tannins that exist naturally in the wine grape. Tannins are usually added to lesser wines to stabilize color and inhibit the enzymatic activity of botrytis.

AMERICAN- it may be an age-old enological practice in France, but it is a recent arrival in California, where many producers are experimenting. Many California producers refuse to officially recognize tannins, fearing consumers would stigmatize the practice as "unnatural" and "interventionist". The structure of wine will fall apart when the supply of tannins is totally exhausted.

AUSTRALIA- There is no consensus among winemakers. Some say it is only for the unimportant wines, others will use it for big, structured wines.

WHY ADD TANNINS?

Tannins play a crucial role in protecting a red wine's flavor and aromatic components from the ravages of oxygen. As tannin molecules oxidize, they bond together to form a longer chain, which has a less astringent mouthfeel. Great wines must be balanced, an integration of concentrated flavors of ripe fruit with firm structure. In red wines, the structure mostly comes from tannins, a natural component of the skins, seeds and stems of the grape. To manage the quality and quantity of tannins, powdered tannins are added to achieve the balance desired.

STABILIZE COLOR- The addition of proanthocyandic (catechin) tannins can help stabilize color. The anthocyanins are extracted principally in the early stages of fermentation (1-3 days). Most tannin extraction takes place later, largely related to the presence of alcohol. Addition of tannins at the beginning stage of anthocyanin extraction helps to protect the free anthocyanins from oxidation and create a stable bond between anthocyanins and proanthocyandic tannins.

IMPROVE STRUCTURE AND MOUTHFEEL- The addition of tannins at the beginning of fermentation can improve mouthfeel and overall structure of the wine. Grapes grown in warmer areas do not have the same phenolic profile as those grown in the cooler regions. At optimum anthocyanin and sugar/acid maturity, grapes grown in warmer regions have lower tannin levels. By supplementing tannins at the beginning of fermentation, the winemaker can broaden the tannin/structure base of the wine.

WHICH TANNINS TO USE

NAME	PROPERTIES	USES
TANIN VR SUPRA	Highly reactive with proteins Combines with anthocyanins Enhances structure and aging potential	RED WINE: - stabilize color, enhance structure - inhibit laccase and protect anthocyanins in grapes from rot - Antioxidant
BIOTAN	Grape tannin component for poor tannic structure in wine	RED,ROSE, WHITE WINES: - Stabilize color - Enhance structure and aging potential
TANIN GALALCOOL	Reactive with protein Inhibits laccase activity Complexes with oxidizable molecules preventing browning	WHITE and ROSE WINES: - Improve clarification - Improve structure - Eliminate reduction odors - Botrytised grapes
TANIN GALALCOOL SP	Reactive with protein Inhibits laccase activity Complexes with oxidizable molecules preventing browning	WHITE and ROSE WINES: - Improve clarification - Improve structure - Eliminate reduction odors - Botrytised grapes - Enhance mouthfeel
TAN'COR	Compensates for lack of tannin in finished wines	RED WINES: - Stabilize color - Enhance structure and aging - Inhibit residual laccase activity - Reduce vegetal and musty aromas - Reduce astringency
TAN'COR GRAND CRU	Compensates for lack of tannin in finished wines, without the dryness that might come from barrel aging Facilitates aging Antioxidant	RED WINES: - Stabilize color - Enhance structure and aging - Inhibit residual laccase activity - Reduce vegetal and musty aromas - Enhance fruit character
QUERTANIN	Strong antioxidant Facilitates aging	RED, ROSE WHITE WINES: - Enhance body & structure - Eliminate storage reduction odors
TANIN PLUS	Compensates for lack of structure in finished wines	RED WINES: - Improve structure

USE OF TANNINS DURING THE LIFE OF A WINE

Additions Before Fermentation

Recommended for use on grapes that have botrytis, mold or rot. Inhibits laccase activity. Prevents oxidation and protects against browning. Sprinkle over grapes in the bin or add in solution at the crusher.

Grape/Tannin	Rate (ppm)	Amount	
Red Grapes- Tanin VR Supra	300-500	30-50g/hl	2.4-4.0lb/1000gal
White Grapes-Tanin Galalcool	50-100	5-10g/hl	0.4-0.8lb/1000gal
White Grapes-Tanin Galalcool SP	100-300	10-30g/hl	0.8-2.4lb/1000gal

Additions During Fermentation

Helps prevent oxidation and stabilize color. If using tannin in conjunction with enzymes, add enzymes at the crusher (not directly with SO2) wait 6-8 hours and add desired amount of tannin into the fermenter. More tannin can be added, according to taste, at the first two pump-overs. This will make tannin available for binding with the proanthocyanins as color is extracted, optimizing the efficiency of additions. When cold soaking or using rotary fermenters, add the tannin solution when filing the tank.

Grape/Tannin	Rate (ppm)	Amount	
Red Grapes- Tanin VR Supra	300-500	30-50g/hl	2.4-4.0lb/1000gal

Additions During Aging

For color stabilization and protect against oxidation. Additions should be made during the first two or three rackings, followed by an organoleptic evaluation. Dosages of 100-200ppm should be added to a barrel or cask during racking.

Grape/Tannin	Rate (ppm)	Amount	
Red Wines- Tan'Cor	100-300	10-30g/hl	0.8-2.4lb/1000gal
White Wines- Tanin Galalcool	100-300	10-30g/hl	0.8-2.4lb/1000gal
White Wines- Tanin Galalcool SP	100-300	10-30g/hl	0.8-2.4lb/1000gal

Additions to Finished Wines

Tanin Plus is a preparation of oak tannins. They have been lightly toasted and impact slightly softer, more aromatic characters to the wine.

Grape/Tannin	Rate (ppm)	Amount	
Red Wines- Tanin Plus	50-300	5-30g/hl	0.4-2.4lb/1000gal
White Wines- Tanin Plus	50-200	5-20g/hl	0.4-1.6lb/1000gal

Quertanin prevents oxidation of the color of red wines and adds to the structural backbone of all wines. For whites, the bouquet is conserved while giving a fuller mouthfeel.

Grape/Tannin	Rate (ppm)	Amount	
Red Wines- Quertanin	100-200	10-20g/hl	0.8-1.6lb/1000gal
White Wines- Quertanin	50-100	5-10g/hl	0.4-0.8lb/1000gal

Choosing the appropriate rate of addition

Bench trials should be conducted to decide on the appropriate rate of addition and tannin additions should be done a minimum of three weeks before bottling.

Napa Valley College, Viticulture and Winery Technology
Standard Operating Procedure

De-stemming and Crushing Grapes

Developed by Liz Christensen and Manbin Khaira Monteverdi
December 2002

II Introduction

The de-stemmer/crusher is used to separate the stems from grape clusters and can be used to crush the grapes. It is used more frequently for processing red grapes although some protocols may require using this equipment for white grapes.

III Equipment

The de-stemmer/crusher is a piece of electrical equipment comprised of:

- The hopper--stainless steel collection basin into which whole grape clusters are dumped.
- The rollers--nylon wheels that can be adjusted to crush the berries or leave them whole.
- The cage--a stainless steel cylinder containing perforations that allow berries, but not stems, to pass through.
- Paddles--designed to move the stems through the cage and out the other side.
- Switches--one to start the paddles, and one to start the rollers. Also, corresponding red safety switches that you push or hit to switch off.
- RPM adjustment lever--to control the speed that the machine turns. This level can be used only while the machine is running.

You will also need: an extension cord, a method for loading grapes into the hopper (a ladder for manual loading or a fork lift truck), and two collection basins such as half-ton picking bins.

IV Preparation

1 The equipment and picking bins should be thoroughly cleaned before use. The hopper, cage and paddles can all be removed to facilitate cleaning.
2 The equipment and the bin for collecting must should be sanitized before use. Spraying with Quat, leaving for 15 minutes and then rinsing is recommended. (Refer to the sanitation section of these SOPs).
3 The rollers will need to be adjusted depending on your protocol. They can be opened completely to allow whole berries to pass through or closed to allow for a slight or very thorough crush of the berries. You will need to experiment to get the adjustment right for your protocol.
4 The speed of the machine will also need to be adjusted by experimentation. Too high or too low a speed will result in excessive numbers of jacks (stem bits) falling through the cage.

V Procedure

Set-up

1 Place all clean and sanitized equipment near the de-stemmer crusher.
2 Place one picking bin directly beneath the machine to catch the crushed berries and juice (must). Place another picking bin at the end of machine to catch the stems. Be sure that some type of material (i.e., cardboard) is used to separate the two picking bins since jacks are not desired in the must bin.
3 Pull the rolling platform up to the machine and lock it in place. Place the FYBs full of grapes in close proximity to the rolling platform as it is important that the hopper is fed at a consistent rate. Overfilling the hopper with grapes causes the grapes to jam in the hopper and under filling the hopper results in the accumulation of too many stems in the must bin.
4 To help the must remain cool have dry ice available during the de-stemming crushing process.
5 If intending to add SO_2, have it measured and mixed. Add one-half the SO_2 mixture into the must bin once one-half of the FYBs have been run through the machine.

Operation

1 Dump 2 to 3 FYBs into the hopper (or enough grapes so that the hopper is at least half full). There should be at least one person at the top of the platform to dump grapes into the hopper and one person at the bottom of the platform to hand full FYBs and take empty FYBs.
2 There are two small black buttons; one for starting the de-stemmer and the other is for starting the crusher. There are two red buttons; one is for stopping the de-stemmer and the other is for stopping the crusher. Once the red buttons have been pushed to stop the machine they have to be pulled out by turning to the right and released prior to starting the machine again. The person responsible for turning the machine on and off should make the whole team working on the machine aware of what is happening.
3 The machine should be set at 420 rpm (roughly the middle of the range) at the beginning of the process and then adjusted as needed. (See Troubleshooting for more details)
4 Press the de-stemmer black button and the crusher black button to start the operation.
5 If your protocol calls for crushing, be sure that the berries are being crushed sufficiently but not too harshly. A good crushed berry should have its skin broken and the pulp should be able to come out.

Wrap-Up

1 Once all the grapes have been run through the machine add the remaining SO_2 and additional dry ice to keep the must cool.
2 If another block is to be run through the machine, be sure to pressure wash the entire machine including the hopper, drum, rollers and the cage inside the drum. If the machine is no longer needed for the day, use the following process to fully clean and sanitize the machine:
3 Open the door on the end of the machine and the door on top.
4 Take out the spindle that contains the paddles and then the cylinder.
5 Pressure wash all the pieces, inside and out and let them dry.
6 The rolling platform should also be completely pressure washed.

7 Pressure wash all FYBs and let them dry before stacking and storing.
8 Remove the picking bin(s) filled with stems, load it on to a truck and take it to the nearby vineyard.
9 The must bin should be covered and moved into the winery and stored per your protocol.

Troubleshooting:

- Too many jacks?
  - ⇒ Adjust the speed
  - ⇒ Increase the amount of grapes in the hopper
  - ⇒ Change the angle of the paddles
- Berries not being crushed enough?
  - ⇒ Adjust the rollers

Napa Valley College, Viticulture and Winery Technology
Standard Operating Procedure

Bleeding (Saignée)

Developed by: Bob Mihalovich, Erica Schubert
Date: Fall 2002

I Introduction

Bleeding is a wine-making technique of ‘running off’, or ‘bleeding’, up to 10% of free-run juice from just crushed red varietal grapes at the time of crush or after a short, prefermentation maceration. The aim of this may be to produce a Rose, or to increase the proportion of phenolics and flavor compounds to juice in the remaining must thus concentrating the red wine made from the juice left behind in the fermenter. If the goal is to produce a Rose, then the juice is fermented and treated like a white wine using controlled cold fermentation temperatures.

This procedure typically involves the removal of 5-10% of the juice from the total volume of must.

Note that bleeding can reduce the nitrogen level in the remaining must

II Equipment

- Beaker, bucket or shovel
- Strainer
- Funnel*
- Carboy(s)*
- Airlock*

* For Rose.

III Preparation

Determine expected volume to be removed (5 – 10%). Triple wash equipment and containers before use. Note that KMBS is added after this process is conducted.

IV Procedure

1. Gently press beaker, bucket or shovel on top of must to remove juice (see photo below).
2. Strain the juice and return any skins to the must.
3. Discard the free run juice or if making Rose, see steps 4 to 6 below.
4. Pour the strained liquid into the carboy using the funnel.
5. Leave enough headspace for fermentation.
6. Add yeast, N and nutrients according to the team protocol (see photo below).
7. Proceed with team protocol on the must.

V General Notes

Saignée is a French term commonly used in France for juice drawn from the Pinot Noir fermentation tanks prior to fermentation.

VI Procedure Photographs

Removing Juice and Skins (note Dry Ice has been added to Must)

Saignée Wine Prior to Fermentation

Napa Valley College, Viticulture and Winery Technology Department
Standard Operating Procedure

Cold Soak

Developed by James Lee and Sandra Peterson
December 2001

I INTRODUCTION

Cold soaking the must at 50 to 60°F for several days before initiation of fermentation by inoculation with active dry yeast encourages oxidative polymerization of phenols, which may be important in wine color stability (Zoecklin et al., 1999).

II EQUIPMENT

½-ton picking bin or macro bin with lid
Plastic wrap
Spray bottle
100-ml graduated cylinder

III CHEMICALS

1% $S0_2$ solution
CO_2 ice
KMBS (For moldy fruit)

IV PREPARATION

1. Clean bin and lid with a 3-cycle wash (See Sanitation Procedures).
2. Clean crusher/destemmer (See Crusher/Destemmer Procedures).

V PROCEDURE

3. If bin cannot be moved after filling, place in cold storage before filling.
4. If used, add SO_2 as KMBS dissolved in must (See Additions Procedures for calculations) and skip step 5. But if mold appears on surface of must on subsequent days, then spray with SO_2 as described in step 5.
5. Sprinkle 2 cups (2 x 250ml) CO_2 ice into cold soak container.
6. Place destemmed/crushed must into container.
7. Spray top with 15 ml of 1% SO_2 solution per ½ ton of fruit.
8. Cover container and seal by wrapping with plastic wrap.
9. Keep refrigerated at 50-55°F for two to four days.
10. Sprinkle 2 cups (2 x 250ml) CO_2 ice on surface of must every 48 hours.

References

Zoecklin, B.W., Fugelsang, K.C., Gump, B.H., and Nury, F.S. 1999. *Wine Analysis and Production*. Aspen: Gaithersburg, Maryland, p. 288.

Napa Valley College, Viticulture and Winery Technology
Standard Operating Procedure

Cold Settling

Developed by Elaine Vocelka
November 2003

I. Introduction

Cold Settling is a clarification process used in white wine production that is carried out after pressing and before alcoholic fermentation. After pressing, the juice will be cloudy due to the presence of vegetative fragments and other suspended solids, known as gross lees. This cloudiness is also known as turbidity.

Turbidity can effect wine quality whereby too high of a concentration of suspended solids can cause an increase in vegetal flavors, mask fruity characteristics, produce sulfuric compounds and increase the risk of oxidation and spoilage. Too low of a concentration on the other hand can lead to a stuck fermentation and increase VA.

Cold settling separates the sediment from the juice, allowing it to settle to the bottom of the tank under the action of gravity. The time required for this operation varies based on particle size and quantity, but usually requires about 16-24 hours. If necessary, cold settling can be extended a day or two if the juice is still too cloudy to rack off. After cold settling, the juice must be racked to another vessel such as a barrel or a stainless steel tank for alcoholic fermentation. Racking is a wine clarification process as well. It is the process of transporting juice from one vessel to another leaving any sediment or deposit behind. The racked juice is generally free of solids but still may require further filtration.

II Equipment

Picking Bin
Pump (if needed for racking)
Wooden Pallet
10, 30 or 40 gallon trash can (depending on size needed), with lid
3 or 5 gallon Carboys (for press fraction)
400 Liter Stainless steel tank with lid or temperature controlled tank (size may vary depending upon quantity of juice)
Siphon hose
Barrel or tank (receiving vessel)
Sieve for staining solids
Saran wrap
Wooden dowel
Garbage bag twist ties or other bendable wire

III Chemicals

- Dry Ice (CO_2)
- KMBS (SO_2)

IV Preparation

1. Clean settling tank (that best suits your needs for the amount of juice you have pressed, i.e.: 30 gallon garbage can, 400 Liter stainless steel tank, glass carboys) corresponding lids and siphon hose with a 3-cycle wash (see "Sanitation Procedures")
2. If racking to a barrel, prepare it by cleaning per "Barrel Cleaning" procedure and fill with water overnight to expand the wood.
3. If racking into a tank, proceed to a 3-cycle wash (see "Sanitation Procedures").
4. If using the pump for racking, proceed with a 3-cycle wash as well.
5. Take a wooden pallet and place a picking bin up side down on it. Place your cleaned receiving vessel on top of the picking bin. This will allow the juice to be at the correct height to rack the juice by gravity after cold settling.

VI. Procedure

1. Press grapes (see separate procedure).
2. If necessary, place the receiving vessel that you will be using for cold settling the juice at a height suitable for using gravity to rack the settled juice.

Settling and Racking from a Trash Can:

1. Transfer the juice into the vessel can using a pump or siphon tube.
2. Add proper amount of SO_2 to juice. (see "Adding SO2 at Crush" procedure)
3. Add 250 ml of Dry Ice pellets to juice and stir gently. Record the starting temperature.
4. When using a 10, 30 or 40 gallon trash can, place the corresponding lid on top of the can. Using a roll of saran wrap, completely seal the lid to the garbage can itself by wrapping the saran tightly around the edges of the lid at least 3 times. This will help keep any air from getting into the juice.
5. Using the pallet jack, place the pallet with the can on it into the barrel room and set the
6. Temperature of the barrel room should be 50-55 F. Leave the juice for 16 to 24 hours.
7. If the juice is not clear enough after 16 to 24 hours, allow it to cold settle for another day.
8. Attach the 1in tubing attached to a 11/2 tri-clamp fitting to the racking valve of the tank. Direct the other end into a (properly prepared) barrel placed below the tank. A funnel may be required. Open racking valve and fill barrel to 6" down.
9. If racking the juice to a barrel from a container with no racking valve, take a siphon hose and secure it to a wooden dowel using a metal twist ties. Make sure the end of the hose is about 2 inches from the bottom of the dowel. This will keep the hose off of the bottom of the vessel and prevent it from picking up any settled lees. Note: When racking white juice DO NOT use a dowel that has previously been used to stir Red juice/wine. Always use a dowel that is clean with no signs of red on it for white wine making.

10. If racking to a tank, use a pump and follow the racking procedure (see Tank Racking Procedure)
11. After juice transfer is complete, discard the lees and clean the emptied tank (be sure to remove all tartrate crystals) and other equipment by rinsing with hot water.
12. The juice is now ready to be inoculated (see “Alcoholic Fermentation” procedure)
13. Make sure to clean the floor and surrounding area of any spilled juice when you are through, as well as any and all equipment used (see Sanitation Procedures)

Settling and Racking from the 400 liter Stainless Steel Tank:

1. Transfer the juice into the 400Liter Stainless steel tank using the siphon hose.
2. Add proper amount of SO2 to juice. (see “Adding SO2 at Crush” procedure).
3. Add approximately 2 x 250ml of Dry Ice to juice and stir gently. Record the starting temperature.
4. When placing the lid to the tank make sure you have at least three people to help. two people to hold the lid in place and balanced while a third person manually pumps the inflatable lid into place.
5. Using a pallet jack, wheel that tank into the barrel room and set the temperature of the room to 55 degrees. Leave the juice for 16 to 24 hours. Check temperature and reload with dry ice as needed.
6. If the juice is not clear after 16 to 24 hours, allow it to cold settle for another day.
7. If the juice is ready for racking to a barrel, take a siphon hose and secure it to a wooden dowel using a metal twist ties. Make sure the end of the hose is about 3 inches from the bottom of the dowel. This will keep the hose off of the bottom of the vessel and prevent it from picking up any settled lees. Note: When racking white juice DO NOT use a dowel that has previously been used to stir Red juice/wine. Always use a dowel that is clean with no signs of red on it for white wine making.
8. If racking to a tank, use a pump and follow the racking procedure (see Tank Racking Procedure).
9. After juice transfer is complete, discard the lees and clean the settling tank, siphon hose and dowel using a 3- cycle wash. If using a pump, clean it as well.
10. The juice is now ready to be inoculated (see “Alcoholic Fermentation” procedure).
11. Make sure to clean the floor and surrounding area of any spilled juice when you are through, as well as any and all equipment used (see Sanitation Procedures).

Settling and Racking from a glass carboy or jug:

1. Transfer the juice into the correct size carboy or jug needed using a siphon hose.
2. Add the proper amount of SO2 to juice (see “Adding SO2 at Crush” procedure).
3. Add proper amount of dry ice and stir gently. Record starting temperature.
4. Using saran wrap, make sure that the opening to the glass vessel it securely covered to prevent any air from getting to the juice.
5. Place the glass vessel up on to the wooden ledge inside of the barrel room. Making sure that the temperature is set to 50-55F and let settle 16 to 24 hours.
6. If the juice is not clear after 16 to 24 hours, allow it to cold settle for another day.
7. If the juice is ready for racking to a barrel, take a siphon hose and secure it to a wooden dowel using a metal twist ties. Make sure the end of the hose is about 2 inches from the

bottom of the dowel. This will keep the hose off of the bottom of the vessel and prevent it from picking up any settled lees. Note: When racking white juice DO NOT use a dowel that has previously been used to stir Red juice/wine. Always use a dowel that is clean with no signs of red on it for white wine making.

8. After juice transfer is complete, discard the lees and clean the glassware, siphon hose and dowel using hot water.
9. Make sure to clean the floor and surrounding area of any spilled juice when you are through, as well as any and all equipment used (see Sanitation Procedures).