

MAKING really good SAKE AT HOME

Using the more efficient Sokujo-moto method, with well polished sake brewery rice and fresh brewery koji a day by day plan
Fred Eckhardt, (c) 1976, 1982, 1993, 1997, 2004, 2007, 2008
all rights reserved may not be reproduced for sale (other than reproduction/distribution costs)
TWO GALLON BASIC RECIPE v6.2 (w/ brewing calendar)

TABLE OF CONTENTS

Two gallon day by day recipe (about)	
Equipment needed	
Cleanliness and sterilization of equipment	
About rice, koji rice, water, and other elements	
BOX: Table one -- Ingredients for better sake recipe	
Preparation of rice	
BOX: Table two -- Chart of Materiels additions	
Sake - stages of ferment	
About fermentation and aging temperatures	
Shubo or Yeast mash (about)	
1st Day (shubo day -1 procedure)	
2nd Day (Shubo day 1 procedure)	
3rd to 4th day (Shubo)	
5th-8th day end shubo	
Start Main Ferment buildup	
8th-9th day buildup, First addition - Hatsuzoe	
10th day Odori dancing ferment	
11th day Middle addition - Nakazoe	
12th day Final addition - Tomezoe	
13th day Main ferment begins - Moromi	
14th to 22nd day	
23rd to 27th day	
Yodan - adjustment stage around 27th day	
MOROMI -- MAIN FERMENT -- END	
Secondary Ferment	
28th to 35th day (Main 16 to 23) Rack and Press	
31st to 39th day	
Orizake	
Evaluation and adjustments, fining & pasteurization	
59th to 80th day -- Storage Adjusting sweet-dry balance	
Bottling and finishing	
Procedure for small batches	
BOX: Sources	
Sake Warm Line for help	
BOX: Table three -- SMV - sg conversions	
The doubling procedure examined	
Sake Brewing Calendar	

TWO GALLON DAY BY DAY RECIPE - VERSION 6.2 (w/calendar)

Sake is unique among fermented beverages, in that the sugar is being produced from starch - by enzymes - simultaneously with the fermentation process - by yeast. The alcohol content can be very high: 16-20% by volume, depending on the rate of polish on the rice (the more polish the lower the alcohol content). Because of the cool temperature requirements of the ferment, it is best to make sake in the late fall to early spring or use refrigeration.

This recipe makes what the Japanese call Nihonshu, Japanese shu (rice beer). It is also called Seishu: refined shu or rice beer. We have come to call it "sake" which is another pronunciation of "shu". They share the same Chinese character.

"Refined." Now that ought to tell the reader something. IT'S NOT SIMPLE. You want simple? Make wine. Get used to it. All-grain beer brewing is not simple either; but if you want that, you do what it takes. Sake brewing is no more difficult, in fact it is easier. All grain brewing takes all day. Sake brewing takes longer, but the steps are much easier. THE HARD

PART IS DOING THINGS IN THE RIGHT ORDER. You will have better success brewing sake if you follow this day-by-day sequence of events, and plan your brewing schedule accordingly. You can make adjustments. You don't have to be a slave to this schedule. However, the closer you can adhere to it, the better will be your finished sake. It is important to note that you will need a half day's time for 3 out of 4 days during the main mash buildup. I suggest a long weekend for starters. Arrange your brewing schedule with that in mind (see calendar at end).

Let me suggest that you make a copy of this master recipe, and mark it with date-time notes about when those tasks need to be accomplished. This will provide a game plan for each sake batch you brew. In addition to that, you should keep an accurate log of the brewing activities for each batch. This particular recipe is designed for using brewery koji and brewery polished rice, both polished to around 60-70%. It should be noted that different polishing ratios require different rice preparation, but these will probably work for any of the highly polished rice you will find on the market.

We are happy to acknowledge the help and assistance of the brewers and management of SakeOne Brewing, Forest Grove, Oregon, especially CEO Steve Boone, former CEO Grif Frost, former CEO Steve Chun, former chief sakemakers Chris Harrison and Abednego Barnes and Chief Sakemaker Greg Lorenz.

EQUIPMENT NEEDED

You need normal winemaking equipment: two food-grade plastic open-topped primary fermenters (2.5-gallon and 5-gallon sizes), a plastic sheet to cover same; several (6) closed secondary storage vessels such as 1-gallon or 4-liter bottles; about 7ft (2.1m) of 3/8-inch (9.5mm) plastic siphon hose and several fermentation locks. You will also need a fairly large double- or triple-deck steaming vessel of at least 2-gallon capacity (35-40cm/14-16 inch, (which can be found here in Portland at Fubonn Super Market, 2850 SE 82d, Portland); a small plastic (or wood wine) press; a specific gravity hydrometer and hydrometer jar are also desirable. Most of this equipment is found at any beer or winemaking supply store (yellow pages under Home Beermaking Supplies or Home Winemaking Supplies).

CLEANLINESS AND STERILIZATION OF EQUIPMENT

All of the equipment used in the fermentation and pressing or bottling of the finished or fermenting product must be absolutely sterile. A sterile solution can be made using about 6ml (1-1/4tspn) Iodofo BT in a gallon/4liter of water. This is iodine: odorless and tasteless at this concentration. It takes 2- 5-minutes to work, does not have to be rinsed, and will not damage stainless steel equipment as will chlorine bleach. The solution is brown at first and can be reused. When it goes to yellow change the solution. You can also use 2-tablespoon of household chlorine bleach in a gallon of water. Rinse the equipment carefully in this solution, and allow to drain completely before using. Water rinse is usually not necessary, as this low concentration will likely dissipate soon and not leave any flavor in the finished sake, but there is no guarantee; the Iodofo is better.

ABOUT RICE AND KOJI RICE (KOME KOJI)

Rice consists mostly of starches, which must be converted to fermentable sugars before a yeast ferment can take place to produce alcohol. The outer layers of the rice grain contain concentrations of protein and crude fats which contribute off-flavors to finished sake. The best sake rice is the so-called short-grain rice which may be polished extensively to produce higher quality sake. Dinner rice is polished to 93% (losing 7% of its mass as rice "flour"); while sake rice is polished to 70% (or even more in the case of premium sake). This recipe is designed for use with such highly polished rice, but not dinner rice. It should also be noted here that different polishing ratios require different steeping and steaming times. If you wish to use dinner rice (Homai, Kokuho Rose, etc.), follow the directions in my book Sake (USA) or those in my earlier recipes in this series, some of which are found on the Internet at www.spagnols.com.

The sake brewer separates 20-25% of the total rice (we use 25% here), from which to grow kome koji or rice koji and which we'll simply call koji. Koji is produced by inoculating the rice grains with a mold (koji-kin: aspergillus Oryzae a relative of Penicillium). These mold spores are also called "seed" or tane koji. Growing your own koji is a bit tedious, so we have by-passed that 2-day process in favor of using commercially available brewery koji. Please note that you can NOT produce usable koji by merely adding rice and water to some kome-koji. CAN NOT. You must use home grown koji, OR commercially grown koji. Period. This recipe calls for 40-ounces (1.13 kg) of brewery koji. Other commercial koji and koji-kin are available on the market. See SOURCES (end).

WATER

Your water should be relatively soft, with no iron in it at all. Do NOT use water that has ANY iron in it. If your water is not soft, dilute with, or use, distilled or deionized water. If so, you may wish to add the Morton Salt Substitute as a water hardner in the yeast mash. This is the only generally available chemical addition with a good concentration of proper nutrients and water adjustment for sake brewing to match the famous Japanese miyazumi (heavenly water): potassium chloride, fumaric acid, tri- and mono-calcium phosphate.

Extra water (to reduce alcohol to the normal commercial level 15-16%abv) should be added much later at the Yodan stage, e.g. about 28-oz (830ml) will make sake with normal commercial ABV of 16%. Be very careful; such water, once added, cannot be removed. Pay attention to our warnings throughout this recipe.

OTHER ELEMENTS

The yeast needs other nutrients: Epsom salts and regular winemaker's yeast nutrient will suffice. The alcohol content may be controlled by varying the addition of water late in the procedure (Stabilization Stage -- yodan). Our recipe will produce

about 2-USgallons (7.6-liters) of full strength 18.5 - 19.5% alcohol (by volume -- genshu strength) sake. Adding more water will produce additional sake, but with lower alcohol content. Use of even more highly polished rice (to 50% or more), will also reduce possible alcohol content by a small amount, while greatly improving the sake's quality.

>>>>>box<<<<<

TABLE ONE

INGREDIENTS for better SAKE RECIPE

(Two gallon single recipe--may be halved, doubled or tripled)

U.S.	item	metric
10-lbs	Brewers polished rice (to 58-70%)	4.54kg
2.5-lbs(40-oz)	Koji	1.13kg
2-USgal	Water	7.6 l
PLUS acid adjustment using lactic acid if possible:		
1-tspn	Lactic acid 88%	3.8ml
or, alternately, if no lactic acid is available		
8/10-tspn	Winemakers citric acid, or acid blend	4.1gm
AND the following:		
3/5-tspn	Winemaker's yeast nutrient	4gm
A pinch of Epsom salts (magnesium sulfate--MgSO4)		0.7gm
ALSO		
yeast	WyEast sake yeast K9 strain (type #3134)	tube
1.25-tspn	Morton Salt Substitute (only) [optional]	6gm

>>>>>box<<<<<

PREPARATION OF THE RICE--BREWERY POLISHED RICE AND KOJI

This recipe is for brewery polished rice (to 70 -50%) and koji.

For each addition prepare the rice as follows:

1. Cover the rice with 2- 3-inches (50- 75mm) of very cold water; wash and work the rice (intermittently by hand) while steeping for about an hour (with several changes to remove the rice starch), and drain for another hour before using. The object here is to add moisture to about 25-30% by weight. I don't recommend it, but you COULD steep for 6- 11-hours and drain for 1-hour (which is not as good -- but might be more convenient for your work schedule; perhaps allowing you to do that step the night before), with only a minimal effect on the quality of the finished product.
3. Place the rice in the double deck steamer - which must have plenty of water in the bottom to allow for the long 1-hour steam. The rice is not boiled, but steamed - separated above the boiling water - for an hour.
4. The koji for each addition (except that for the very first step - the shubo or yeast mash) is always added to the mash about 12 hours before adding the freshly steamed rice for that addition. At that time also add half of the water for the next addition as well. Refrigerate the other half of that water overnight. This will help cool the freshly steamed rice when that is ready (the next day after 12-hours).

PREPARATION OF RICE -- DINNER RICE AND COMMERCIAL KOJI

Dinner rice needs different treatment than our brewery rice (above).

1. Wash the dinner rice completely and thoroughly in running cold water to remove all starch powder.
2. Cover the rice with 2- 3-inches (50- 75mm) of very cold water, and stand in your refrigerator to soak for about 18-hours before using. Properly soaked rice is slightly less than crunchy and nibbles easily (if it's squishy it has soaked too long, if very crunchy it's not soaked long enough). Don't forget there is an entirely different procedure for dinner rice.
3. Drain off the cold water, and place the rice in the steamer -- which must have plenty of water in the bottom to allow for the long 45-minute steam. The rice is not boiled, but steamed, separated above the boiling water in the steamer. Steamed rice is ready when it is not quite Al dente (as for spaghetti), it should not be soft and goeey as cooked rice is. After steaming, the grains separate easily, although they do have some tendency to stick to each other.
4. The koji for each addition (except that for the very first step, shubo or yeast mash) is always added to the mash 12- 18-hours before adding the rice for that addition. Add the koji portion, for each addition, directly to the fermenter at the same time that you set the rice, for that addition, to soak in the refrigerator.

BROWN RICE (GENMAI-SHU)

Brown rice can be used, but it is not recommended. Brown rice has too many nutrients, proteins and fats, which will encourage souring infections in the ferment. If you insist on making genmai-shu or brown rice sake, follow the domestic dinner rice procedures (above), but add 10% more rice in all additions, and soak each addition for 36-45 hours (instead of

18) and you must steam the rice an hour-and-a-half to two hours (instead of 45-minutes). Check the progress of steaming by squeezing a grain between your fingers. It should squeeze under pressure, but squishing easily indicates too long a steam. Finally, leave out the nutrients mentioned earlier. Do not use or make koji from brown rice. Use commercially polished rice koji (polished to 70 to 90%). Again, there is an ENTIRELY DIFFERENT PROCEDURE to make Brown Rice sake.

>>>>>box<<<<<<

TABLE TWO -- CHART OF ADDITION OF MATERIALS

	Yeast Mash	First day 1	Middle day 8	Final day 10	Final day 11	Addition	Totals
Steamed- rice	ounces	12	7.5%	20	12.5%	48	30%
	cups (8oz)	1.6	2.7	6.5	~11(bal)	~21	80 50 160 (10-lb)
	grams	340	570	1,360	2,270	4,540	
Koji	ounces	4	10%	7.25	20%	11.25	30%
	cups (8oz)	0.75	1.5	2.25	~3.5(bal)	8	40 (2.5-lb)
	grams	115	205	320	500	1,135	
Water	fl. Ounces	20	7.8%	22	8.3%	70	27.6%
	cups	2-1/2	2-3/4	8-3/4	16	30	128 56.3% 240
	cc/ml	590	650	2,070	3,790	7,100	
8-oz Cup weights: sake ratios are all volumetric 1 cup rice = 7.5oz							
1 cup koji = 5oz							

Percent values of total: Water volume is 126% of rice/koji volume. Additional water is needed, after the ferment, to reduce the alcohol level to a more reasonable 16.5%abv for normal consumption. Percentage notes are a percent of the total for each addition.

>>>>>BOX<<<<<<

SAKE--STAGES OF FERMENT

The ingredients are assembled in the fermenter in five increments:

1. Shubo or yeast mash.
2. Moromi or main ferment, consisting of
 - a. Hatsuzoe, first addition
 - b. Nakazoe, middle addition
 - c. Tomezoe, final addition.
 - d. Yodan or stabilizing addition.

The various stages of fermentation require different temperatures. These can be as low as 40F/4.4C which would probably require refrigeration, and warmer (50-60F/10-16C) which might call for a cellar, or at least a cooler time of the year, such as fall-winter-spring. Some of the ferment is done as warm as 73F/23C which would require a warm room. I solve these problems by fermenting in the winter and moving the ferment about my house and garage to achieve the necessary temperatures for the various stages. Careful temperature control is essential to making good sake.

For the most part: cooler is better. Since the end of the 16th century Japanese sake brewers have centered their sake production in winter (kan-zukuri-zake). We suggest you do likewise.

SHUBO OR YEAST MASH

(total time 7-days)

The brewing process begins with the yeast mash or shubo as it is called. Our original recipe in Sake (USA) used very traditional methods to start the shubo. This was a modification of the original ancient, and traditional, method for preparing the yeast mash called yamahai moto, it is still used by some Japanese sake brewers to this day. That method was tedious and convoluted, but entirely natural, except that one could add yeast to the mash. This complicated procedure made sake brewing seem far more difficult than it was. The real difficulty lies in organizing the steps of the process, so as to do each in its proper turn, as we have done here.

This recipe incorporates a more modern procedure which has the advantage of being simpler to carry off, while also reducing the acidity of the finished sake. The long yamahai mash relied on natural lactobacillus for pH reduction. In this procedure, called sokujo-moto, you add an acid adjustment. The net result is lower total acid in the end product and simpler production steps. While the sokujo method was invented in 1909; it has been improved and updated often since that time. It is currently the most popular yeast mash production method in use by Japanese sake brewers. Commercial lactic acid (88%) is called for, but homebrew and winemaking supply stores don't always stock lactic acid. If that is the case, you could also use the equivalent, and more available, but not as good, dry citric acid.

ABOUT THE FERMENTING AND AGING TEMPERATURES

We give temperature ranges here. Always try for the lowest end temperature in each case. I accomplish this by moving the ferment about my house, using the basement and garage where necessary; as I do not have temperature controlled aging spaces. I, in the fashion of the ancients well as modern Japanese, do my sake ferments in the winter (kan-zukuri-zake).

Date started _____
1st day (Shubo day -1)
start shubo yeast mash
Wash, steep rice overnight
set water, prep

FIRST DAY: SHUBO - THE NIGHT BEFORE DAY ONE

1. a. Important Please note that you must add very active yeast to this yeast mash: (#4.a. below) and that means you must start the incubation of your WyEast packet early enough. The yeast **MUST** be stored under refrigeration. Bring the packet to a warm temperature 80F/27C, about twenty-four hours ahead of time to ensure the yeast to be fully active when added. A high concentration of yeast cells (10-5 to 10-9/mg) is needed at that time.
2. a. That evening, prepare 2.5 cups (20-oz/600ml) good brewing water that has been de-chlorinated by standing for a couple of days. The water should be low in hardness (less than 200 ppm), and with no iron content at all. If your water department uses sodium or calcium chloride as the active agent to chlorinate your water supply, do not use that water; instead, dilute with distilled, or de-ionized water. You can verify all this by calling your water department. Don't use hard water either (over 200ppm), at least not for the shubo mash.
b. To this water, add the water adjustment chemicals: the lactic acid 88% solution (1-teaspoon/3.8ml) or winemaker's citric acid (4/5-teaspoon/4gm) [to prevent harmful wild yeast growth]; the winemaker's yeast nutrient (3/5-teaspoon/4gm); Epsom salts (pinch/0.7gm); and Morton's Salt Substitute (optional but no other brand please), (1-1/4 teaspoon/7gm); stir to thoroughly dissolve all of those chemicals - they provide nutrients for yeast growth.
c. Separate a half cup (4-oz/120ml) of this treated water, and put that in the refrigerator. Cover the remaining treated water, 2 cups (16-oz/480ml), and store in a cool place (about 59-64F/15-18C) overnight.
d. Clean and sterilize a small three-quart wide-mouth flat bottomed vessel to use as a fermenter for your shubo.
e. If you have stored your koji in the freezer move it into your regular refrigerator. Keep it refrigerated until you actually use it.

2nd day (Shubo day 1/7)
AM warm yeast
drain, and steam rice
PM stir

SECOND DAY: SHUBO - DAY ONE - MORNING

3. Wash and steep 1.6-cups (12-oz/340gm) rice: wash/steep for 1-hour and drain for 1-hour at room temperature. Ordinary cold tap water will do for this.
4. a. Now add the fully active WYeast Smack pack (activated as per instructions) contents to the 2-cups of water you left

standing 24-hours (at 70-5F/21-4C). Leave this sit for an hour, while the rice is draining, and:

b. Add 8/10-cup koji (4oz/115gm) to the water yeast mixture (above #4.a.), and stand for another hour. Check the temperature of the mix, which should still be around 70-5F/21-4C. If you checked the pH, (which isn't necessary); you'd probably find it at 3.6-3.8 or so. Do this while the rice is steaming (1-hour).

c. Steam the rice 1-hour, and then cool it with the four ounces of chilled water (#1c above). Add this to the water-koji mix. The resulting temperature should be somewhere around 75F/24C. If it is too warm, (above 90F/32C), the heat may damage the live yeast. Do what you can to get the temperature to 72F/22C as soon as possible (i.e. float a sterile container of ice cubes in the mash).

d. Mix gently, but well, by folding the rice - water - koji - yeast mix for about 5-minutes. Gently and smoothly, please. (A sterilized stainless steel stirring spoon is OK for this). Cover with a plastic sheet. Keep the mix out of strong light which can damage sake.

THICK SHUBO - DAY ONE EVENING

5. 12-hours later -- stir gently again for about five minutes. By now the rice-mash cake may rise above the water.

3rd day (Shubo day 2/7)

Stir 2x @ 12-hrs

THIRD DAY: SHUBO - DAY TWO

6. Stir gently twice (morning and evening, at about 12-hour intervals). During this period gradually raise the temperature to 73F/23C and maintain that temperature as best you can.

4th day (Shubo day 3/7)

maintain temp

stir 2x @ 12-hrs

FOURTH DAY: SHUBO - DAY THREE

7. Continue to maintain the temperature (73F/23C) through the sixth day and stir twice daily (at 12-hour intervals).

5th day (Shubo day 4/7)

stir 2x @ 12-hrs

FIFTH DAY: SHUBO - DAY FOUR

Continue to maintain the temperature (73F/23C) through sixth day and stir twice daily (at 12-hour intervals), .

6th day (Shubo day 5/7)

stir 2x @ 12-hrs

SIXTH DAY: SHUBO - DAY FIVE

Continue to stir twice daily (at 12-hour intervals).

7th day (Shubo day 6/7)

begin lowering temp

stir once

SEVENTH DAY: SHUBO - DAY SIX

8. Stir once and start lowering the temperature gradually from 73F-23C to 59F/15C by the end of the eighth day (day six, last of shubo) - the night before you start the MAIN BUILDUP (next). Your yeast mash is almost finished, with only one more day. Tomorrow, the last day of shubo, you will set the stage for the main mash buildup. By now the alcohol content will be about 6%abv, SMV -60/1.042/10.8P.

8th day (end Shubo, day 7/7)

Buildup day -1

PM add koji and water to

yeast mash

wash and steep rice for AM

Date started _____

Eighth DAY end SHUBO - MAIN MASH BUILDUP: THE NIGHT BEFORE DAY ONE

1. a. The night before starting the main ferment, add koji (1.5-cups/7.25-oz/205gm) to the yeast mash (which has been working for 7-days). Fold the koji gently into the yeast mash (Shubo), and add half of the 2-3/4 cups (22-oz/650ml) water required for the next step, or about 1-1/2 cup (12-oz/355ml), stir gently. By now the mash temperature should be 59F/15C, place the remainder of that water (10oz/295ml) in the refrigerator to chill. You will need this in the morning to help cool the freshly steamed rice.

b. Wash and steep 2.5 cups rice (20-oz/570gm) in water and leave overnight, for use in the morning. OR do that on the ninth day before starting and stand for only an hour at that time.

MAIN FERMENT BUILDUP

(time four days)

The Buildup ferment will be in three stages over a four day period. The stages, or additions, are called first addition (hatsuzoe), second addition (nakazoe), and final addition (tomezoe). Each consists of a further portion of koji, steamed rice, and water. These sequential additions each double the volume of the mash until the main ferment can take place over about three-weeks. Specific procedures follow. Beginning here the water can be ordinary tap water (no iron, under 200ppm hardness), although the distilled or de-ionized water would be slightly better. If your water is too hard with no iron, you can cut it with distilled as necessary to produce 3-500ppm as you desire.

REMEMBER -- if you are pressed for time (i.e. you work for a living) you could always wash and soak the rice the night before, rather than, ideally, in the morning, before draining and steaming. In any case place the water for each addition in the fridge overnight for use AFTER the morning's steaming and draining, to cool the freshly steamed rice each morning.

The buildup in three additions:

First addition - hatsuzoe, followed, the next day, by the odori or dancing ferment.

9th day (Buildup day 1/4)

drain and steam rice

cool shubo to 50F/10C

add shubo to mash

First Addn (Hatsuzoe)

NINTH DAY: BUILDUP -- DAY ONE

1. a. Drain the first night's rice addition for an hour, and then steam it and drain it as described earlier.

b. While this is going on cool the mash to 50F/10C.

2. When the rice has finished steaming, spread it out on a clean surface, a couple of inches/5cm thick, and allow to stand 15-minutes to dry (this drying process hardens the rice, hence reducing the moisture level in the grain). We should note that the purpose of this is not so much to cool the rice as it is to dry the grain's surface before adding it to the main ferment. Use a spoon or a fork to break up the freshly steamed, and drying, rice as it cools. Next, move the steamed and dried rice to your small, clean, sterilized, 2.5-gallon plastic open fermenter. Cool it by adding the water from the refrigerator (above), and/or place the container in a cold water bath. Be sure the mass has cooled well before adding the shubo ferment, so as not to damage the active yeast mash.

3. Now add the shubo, or yeast mash (which has been fermenting for 5- 7-days), to the fermenter, and mix with mild agitation, gently but thoroughly, for about 5-minutes. Cover the fermenter with a plastic sheet and cool to 55F/13C. Do what you can to get the temperature to 55F/13C as soon as possible (i.e. float a bag of ice cubes in the mash, place it in a cold

water bath, or - if necessary - heat by floating a small plastic bag of hot water in the mash). Finally, move the fermenter to a cold dark area (or cover with a blanket in a cold area) -- remember, light is damaging to sake.

4. Stir gently 12-hours later, that evening, and at 12-hour intervals for a total of 48-hours.

10th day (buildup day 2/4)

Odori ferment

continue stirring @ 12-hrs

PM add koji for next

addition

Wash and steep rice for AM

10th DAY: BUILDUP DAY TWO -- ODORI FERMENT

5. Stir, or gently agitate, at about 12-hour intervals, for a total of 48-hours time (from steaming). The second 24-hour period is called odori, or dancing, ferment. By now you have tripled the volume of the original shubo, and the ferment will be quite active.

6. a. The night before day three, add koji 2.25-cups (11.25-oz/320gm) to the main mash. Fold the koji gently into the mash, and add over half of the 70-oz/2.07liter water required for the next step, or about 40-oz/1.2liter, stir gently. Lower the mash temperature to 55-68F/15-20C (the lower temperature is much better), place the remainder of that water (30oz/870ml) in the refrigerator to chill overnight. Chill that water as cold as you can manage without freezing it. Clean and sterilize a larger fermenter (5- 8-gallons or so).

b. Wash and steep 6-cups of rice (48-oz/1.36kg) in water overnight.

11th day (buildup 3/4)

middle (naka)

drain, steam rice, dry, cool

add to mash mix

11th DAY: BUILDUP -- DAY THREE

Middle Addition (Nakazoe).

1. This starts 48-hours after the first addition.

2. Steam the next segment of rice (48oz/6.5c/1360gm) in the usual fashion.

3. When the rice has finished steaming, spread it out on a clean surface, a couple of inches/5cm thick, and allow to stand drying for 20-minutes or so. Gently mix it into the fermenting mash. Cool it by adding the water you saved, and chilled, in the refrigerator (#8a above), and/or place the container in a cold water bath. Be sure the mash has cooled well before proceeding. Gently mix this, with mild agitation, into the fermenting mash for a few minutes. Lower the temperature to 48-60F/9-20C as quickly as you can. Stir gently again after 12-hours. Keep the mash covered. By now you will have doubled the volume to about 2-gallons. Keep the temperature 48-60F/9-20C. From here on maintain these low temperatures if possible.

4. a. That night, add what's left of the koji (about 3.5-cups/17.5-oz/500gm) to the main mash. Fold the koji gently into the mash, and add over half of the 128-oz/3.79liter water required for the next step, or about 10cups/80-oz/2.4 liter, stir gently. Maintain the mash temperature at 48-60F/9-20C (lower temperature is much better), place the remainder of that water (6-cups/48oz/1.4 liter) in the refrigerator overnight. (see adjustment stage box*).

b. Wash and steep 10-cups of rice (80-oz/2.27kg) in water overnight for the final addition, or better yet do that in the morning before steaming.

12th Day (Buildup 4/4)
final (tomezoe) addition
drain, steam rice, for mash
add to mash, mix
PM stir @ 12-hr

12th DAY: FINAL BUILDUP -- DAY FOUR
Final Addition (Tomezoe). 24-hours after last (middle) addition.

1. Chill the above 64-oz water as cold as possible without freezing; then wash and steep the remaining rice (about 5-lbs) for 1-hour, and let it drain for 1-hour.
2. At the proper time, steam the rice for one hour; and while this is going forth, clean and sterilize your large fermenter if you haven't already done so.
3. When the rice has finished steaming, spread it out on a clean surface, a couple of inches/5cm thick, and allow to stand 30-min, or longer, to dry and cool. While it is cooling, mix and turn the grains with a fork or spoon.
4. In the large fermenter, transfer the above freshly steamed and dried rice. Add the 6-cups water you have chilled earlier. Be sure the mass has cooled well, and is no warmer than 90F/32C, before adding the fully fermenting mash from the small fermenter. This will again double the mash volume to about 4-gallons/15liters. Be sure to stir at 12-hour intervals through two more days. Cool to, and keep the temperature at, 45-60F/10-16C, and remember cooler is better. These final additions and fermentation activity will enlarge your mash considerably. Keep a careful watch so it doesn't overflow your fermenter. If that seems imminent dip out a portion to another smaller container, and add it back later when the ferment recedes, as it will. See adjustment stage box.*

13th day (Main 1) moromi
PM stir @ 12-hr interval
cool to 45F/7C if possible
Date started _____

13th Day: MOROMI or MAIN FERMENT PROPER
Moromi -- FIRST DAY. Lower the temperature to below 60F/15.5C if you have not already managed that. It could be even cooler: as low as 45F/7C. Keep the fermenter covered and cool -- this should be a long slow ferment. From this point onwards, the timing of transfers, adjustments, etc., is dependent on the progress of the ferment and it's temperature. The day-by-day schedule may be quite flexible from this point on; but remember to stir morning and evening. If your ferment is moving too fast your mash may overflow, and you might have to transfer some of it to another small vessel (low temperatures help prevent this). Keep a close watch for a possible overflow.

14th day (Main 2)
stir @ 12-hr intervals
maintain low temperature
take gravity sample

14th DAY: MAIN (MOROMI)
1. Stir gently and twice daily until the ferment recedes. Keep covered and at 45-60F/7-15.5C as described above. By now the alcohol will be around ~3.5%abv/-75SMV/13.5P/1.053. In the first 14-days main ferment most of the alcohol is formed, often at about 1%/day. Mid-moromi is most productive.
2. (Optional) take samples on the 2nd and 7th days to determine specific gravity with your hydrometer. Specific gravity will drop from 1.045 to 1.020, and continue falling.

15th day (Main 3) through
18th day (Main 6)
maintain temperature
45F/7C - 60F/15.5C

15th through 22d Day: MAIN (MOROMI) DAYS 3-10.

1. Stir gently once or twice daily as necessary.
2. Along about the 15th day (main 5) ferment recedes enough to combine fermenters, (if you've had to use two of them).
3. (Optional) take samples on the 7th day or so, to determine specific gravity (SG) with your hydrometer. SG will drop from 1.045 to 1.020, and continue falling, perhaps even faster. By the tenth day of the main ferment look for 11.5abv/9P/1.036.

19th day (Main 7)
maintain temperature
take gravity sample

20th - 22d day (Main 8-10)
maintain low temperature

23rd day (Main 11) through
27th day (Main 15)
maintain low temp
to finish

23rd to 27th DAY: MAIN/MOROMI DAY 11-15

4. By the 11th - 15th day or so, the main ferment should be nearly over. Maintain a low temperature -- as low as 45F/7C if you can. You are ready to make adjustments to stabilize and finish the main ferment. Look for 4.5P/1.0155/alcohol about 15% to start and 3P/1.012/SMV -17.5 by around Main 15.

27th day (Main 15)
Yodan
final rice water adjustment
Take care
Yodan date _____

About the 27th DAY: FINAL ADJUSTMENT (YODAN) - MAIN 15

Yodan: Traditional Japanese sake brewers used a "fourth" addition (yodan) to soften the sake and bring it to an end before pasteurizing

it and ending the ferment. They add some rice kept out of the Third addition for that purpose. There are a number of other adjustments, but we are going to skip those traditional steps and take some shortcuts. After you have brewed a number of sake batches you will have a much better feel for such nuances; but we'll skip that for now.

When the gravity drops below zero, depending on the fermenting temperature and other factors you will probably want to stabilize and adjust the alcohol content.(see adjustment stage box* - below). The Water Addition consists of adding about 40- to 156-oz/1180-4600ml of chilled water, the amount of which will depend on the final desired alcohol content. Be very careful because WATER ADDED CANNOT BE REMOVED; and also remember to save part of the water additions for unforeseen uses, such as topping up your fermenters in secondary aging. Ration your water carefully, there's no second chance. Un-used water (no more than a cup or so -- 8oz) can also be added at final end-adjustments before bottling and final pasteurization.

pasteurize and cap it, because the nigori is still alive and in ferment -- if not: always keep it refrigerated -- with loose closures -- in case fermentation does continue.

2. These containers, with their sake, should be placed under fermentation lock. Fermentation locks are small inexpensive plastic fittings which hold water, permitting the escape of carbon dioxide without allowing the entry of oxygen, which can damage the sake. Keep them under observation until you are certain there is no more ferment. Keep them covered and shielded from light at all times. Light and oxygen are the enemies of sake. Keep the storage temperature of these secondary fermenters low at around 45F/7C.

31st day to 39th day
Main 19-27, Secondary 1-9
ten days resting
maintain temperature 45F/7C

31st to 39th DAYS: END OF FERMENT -- MAIN 19-27, SECONDARY 1-9

3. The end of ferment is signaled when there are no more bubbles in the fermentation locks. Keep the temp around 45F/7C.

40th to 48th day
Main 28-36, Secondary 10-18
Date top-up _____
Refrigerate
hold for 10 days

40th to 48th DAY: TOP-UP AND REFRIGERATE. SECONDARY DAYS 10-18

4. The fermentation locks should be removed from the bottles, and you should "top up", using one of the jugs to fill the others to the upper neck, so as to reduce air space. The remainder from that jug should be moved to smaller bottle(s). All should be capped (loosened) and placed in the refrigerator at 35-38F/2-3C for about ten days.

49th to 58th day
Main 37-46, Secondary 19-28
Rack, strain & fine
date _____

49TH to 58th DAY: RACK, STRAIN AND FINE: SECONDARY 19-28

After ten-days, the sake should be racked again (to two or three more sterilized wine jugs) and strained through about 4 layers of gauze to remove any remaining solids.

ORIZAKE

Sake is, by its very nature, brewed with thick rice dregs present all through the process until the very end, when it is pressed and filtered. Our recipe includes pressing, to separate the heavy dregs, which is followed by a further settling of the remaining abundant light sediment (above).

The small quantity of the finished product (about 2-1/2 gallons) makes it difficult to filter with the usual amateur winemaking equipment. However, we can then decant the finished sake off those dregs at bottling time. Such lightly sedimented sake is called "orizake." We could actually call it "hefe-sake", especially so, since it actually is beer. Don't worry about this small amount of oxidation -- live with it.

The small quantity, and the fact that pasteurization is necessary, also makes bottling very difficult. Wine and beer are normally siphoned into small bottles for finishing. This is almost impossible with hot sake. A better system is to decant the hot pasteurized sake from the larger wine jugs by pouring carefully into smaller bottles.

EVALUATE THE SAKE FOR FINAL ADJUSTMENTS

At this point the sake may show something like this (assuming around 10 liters/338-fluid ounces total volume, in perhaps 3 secondary containers under fermentation lock). Our simple analysis:

Sake Meter Value about +16/sg 0.989/-2.9-degrees Plato

About 16-17% abv

Total acidity (TA) as high as 3.0 (as succinic)

SEVERAL ADJUSTMENTS CAN BE MADE

1. Pasteurization is necessary to inactivate the koji enzymes and disinfect the beverage. PASTEURIZATION IS REALLY VERY IMPORTANT IN MAKING AND STABILIZING SAKE. Place the storage jug in a hot water bath, with a thermometer sticking in the neck. Heat the water bath slowly until the thermometer shows 140F/60C, and remove the jug, cap it and allow to cool. Don't worry if it looks like it is boiling; it won't actually boil at that temperature.
2. If you don't want to pasteurize your sake, don't; BUT that sake is called nama or draft sake. It must ALWAYS BE KEPT REFRIGERATED.

59th to 80th day

Storage about 20 days

Main 47-68

pasteurize for aging

Date _____

59th to 80th DAY: STORAGE ABOUT 20 DAYS

When the sake is clear, and well settled, rack again and be very careful not to siphon any of the light sediment from the bottom of the old jugs to new, clean (and sterilized) jugs. It is quite difficult to get totally clear sake without filtering. However, you needn't worry if there are a few grains of sediment in the bottles. Or you could decant it one more time. You won't be able to taste the difference.

ADJUSTING THE SWEET-DRY BALANCE -- FINAL

1. As noted earlier, our finished sake is rather dry at SMV +16/s.g. 0.989/-2.9P, TA 2.7. Dry sake is nice, but it can get on your nerves at this level. You may want to adjust sweet-dry balance by adding a small amount of sugar in syrup (see below). You might also wish to reduce acidity a bit, by the addition of water. Winemakers call such changes amelioration. Taste as you go.
 2. Compare this with a regular California commercial sake (Ozeki -- our measurements -- you should measure your own favorite sake, so you can match their SMV and TA as close as possible): SMV +5/sg 0.9966/-0.9 degree Plato, 16% abv, TA 1.7.
- You, the sake brewer, may wish to make some of the adjustments we describe above. They will improve the palatability of your sake. The final adjustment, a tune-up of the sweet-dry balance, is best left until bottling time. (NEXT)
3. Otherwise store your finished sake for 3-weeks to 6-months at 50-60F/10-16C, until you are ready to bottle.

WHEN ready

Bottle and finish

pasteurize again

bottling date _____

BOTTLING AND FINISHING

1. You can use champagne bottles (1.5-liter, 750ml, or 375ml) if you are a beermaker, because they can be crown capped. You can also use regular beer bottles. If you are a winemaker, you can use cork-finish wine bottles, or screw-cap bottles from your winemaking supply store. Sake is best in brown bottles and kept away from the light. Light and air can damage sake's quality.

2. The sake should be pasteurized once again before closures are added, since THE FINISHED PRODUCT IS SUSCEPTIBLE TO CERTAIN VERY DAMAGING LACTOBACILLUS INFECTIONS. Pasteurization should not effect the flavor negatively. If you've never tasted SOUR sake, trust me you've not tasted real SOUR!

PROCEDURE FOR SMALL BATCHES

The three storage containers will have your clear sake, as it is ready, to bottle. You can calculate the total volume, and then determine how much (if any) sugar to add. Unless you did some serious adjustments at the yodan stage, (*see box:

ADJUSTMENT STAGE earlier), you will have about 9-liters/304-ounces sake at about SMV +13/sg 0.991/-2.8-degrees Plato. It would be prudent to raise the sg from 0.991/SMV +13 to about 0.995/SMV +6, a decrease of SMV by 7 (+13-7=+6) to SMV +6. Some commercial sake breweries also resort to amelioration under some circumstances. For you it will simplify producing the perfect sake for your personal use.

The standard winemaker's formula for such sugar additions is 4-ounces of household sugar (sucrose) to increase the s.g. 12 points/18 SMV in one US-gallon. For 1-s.g. point this is 0.33-oz (9.45gm)/USgal (3.785 liter), or 2.44gm/liter.

If we translate these figures to SMV (a factor of 0.7 times) we find 1 SMV needs 0.23-oz (6.6gm)/USgal sugar, or 1.75gm/liter. This will change the SMV by one unit. We wish to sweeten the sake by decreasing the SMV by a factor of 7, from +13 down to +6; which is to raise the sg from 0.991 to 0.996 (See Table Three).

Remember that the positive SMV numbers indicate dryness, which is what we are reducing by making the sake sweeter. The drop of 7 SMV is accomplished by adding sugar in the amount of 1.75gm/liter. We have about 9-liters (2.37-gal) to work, so that's 1.75gm x 9-liters x 7 SMV = 110.3-gm sugar, or 3.9-ounces of household sugar, rounded to 4-ounces -- don't be fussy. Your fermenting equipment will probably include the 4-liter "gallon" bottles, which is why I am giving you both metric and American units. You may very well end up calculating in metrics because of that fact.

Make up a sugar-sake syrup by measuring 4-ounces of sake (1/2 cup), warmed to about 125F/52C, to which you will add 4-ounces of sugar (1/2 cup). By using sake to make your sugar syrup you will minimize the reduction of the alcohol content of your sake with the addition of sugar syrup. This will give you about 8-ounces of fluid to apportion carefully among your fermenters to raise the gravity of the whole sake batch. After adding the sugar syrup, be sure to rotate each container to mix the sugar syrup into the sake.

I usually start by placing one of my "topped-up" or full sediment-free wine jugs in a kettle with a boiling water bath on the stove. I check the temperature regularly until it reaches pasteurization temperature of 140F/60C, at which point I quickly remove it from the heat and pour/funnel it into bottles (cleaned and sterilized of course). It is almost impossible to siphon from a one "gallon" bottle of hot sake, so I don't even try, just decant. I repeat the process with each of the fermenters.

Sake is ready to drink at any time after it is bottled, but a modest aging period of up to six months helps. Sake brewers disagree as to whether further aging is beneficial.

Finished sake is best served chilled to about 45 -50F/7 -10C, however in cold weather it is also delicious served warm at 109 -119F/43 -48C. Our sake -- final -- SMV+7/0.995 16%abv TA 1.7.

ADDITIONAL READING ON BREWING SAKE

Eckhardt, Fred, Sake (USA), 1992 Portland, Oregon, pp101-152

OUT OF PRINT AND OUTDATED.

Harper, Philip, The Insider's Guide to Sake, 1998 Kodansha International, Tokyo, Japan, pp39-53

Kodama & Yoshizawa, "Sake", Rose, A.H., Ed., Alcohol Beverages, 1977 London/New York: Academic Press, pp423-475 also out of print

>>>>>box<<<<<<

SOURCES:

Brewery-polished rice and brewery fresh rice koji (kome-koji) is available (wholesale AND retail) from F.H.Steinbart Co., 234 SE 12th, Portland OR 97214, 1-800-638-2897.

Cold Mountain Rice koji

Miyako Oriental Foods, Baldwin Park CA 91706

Found in most Japanese grocery stores

Spagnol's Home beer and Winemaking Supplies
rice koji

New Westminster BC (800)663-0954 CANADA

Koji spores (Koji-kin or tane-koji):

Vision Brewing

P.O.Box 108, Nedlands 6909 W.A., AUSTRALIA

visau@uname.com www.kagi.com The product is VERY expensive; the results disappointing, and the recipe confusing.

G.E.M. Cultures
30301 Sherwood Rd, Ft. Bragg, CA 95437
(707) 964-2922

Wholesale sake yeast
(Saccharomyces sake var Yabe, K9)
WyEast Labs (P.O.Box 425, Mt.Hood OR)

Wholesale import Aluminum Steamers
The 35cm aluminum steamer Mong Lee Shang brand is available from Lieh Gee Enterprises,
Taipei,
TAIWAN

>>>>>box<<<<<<

SAKE WARM-LINE TELEPHONE: (503)289-7596.

Warm-Line not Hot-line, I am on Pacific time, so please not before my 9:30 am. It is better to call me mornings (Pacific time), because I am more competent at that time. If you don't get me, leave a message regarding the nature of your problem, and your number, which I can call "collect". Remember I am not very prompt. Please try to keep your contacts to week days. I do function on weekends, I just prefer not to do this on weekends. There is no charge for this service. I want to help you brew good quality sake in your home.

My current email address: eckhardt@pcez.com
U.S. mail: Fred Eckhardt, 35 NE Lombard St, Portland OR 97211

Remember: Sake brewing is easier if you make a day by day plan ahead of time before starting. You can use our calendar here as a guide. Obviously one can cut corners anywhere, but the bottom line is be careful. The more cuts one makes, the more the product degenerates. Perfection is a matter of attention to detail.

>>>>>box<<<<<<

TABLE THREE
SMV-Specific Gravity-Plato-Baum,
CONVERSION TABLE
(60F/15.5C)

SMV	SG	Plato	Baum,	SG	SMV	Plato	Baum,
+18	0.987	-3.3	-1.8	0.986	+20	-3.7	-2.0
+17	0.988	-3.0	-1.7	0.987	+18	-3.3	-1.8
+16	0.989	-2.9	-1.6	0.988	+17	-3.0	-1.7
+15	0.990	-2.6	-1.5	0.989	+15.8	-2.8	-1.58
+12	0.992	-2.1	-1.2	0.990	+14.6	-2.6	-1.46
+11	0.9925	-1.9	-1.1	0.991	+13.1	-2.3	-1.31
+10	0.993	-1.8	-1.0	0.992	+11.7	-2.05	-1.17
+9	0.994	-1.6	-0.9	0.993	+10.2	-1.8	-1.02
+8	0.9945	-1.4	-0.8	0.994	+8.8	-1.5	-0.88
+7	0.995	-1.2	-0.7	0.995	+7.3	-1.3	-0.73
+6	0.996	-1.0	-0.6	0.996	+5.8	-1.0	-0.58
+5	0.9966	-0.9	-0.5	0.997	+4.3	-0.8	-0.43
+4	0.997	-0.7	-0.4	0.998	+2.9	-0.3	-0.29
+3	0.998	-0.5	-0.3	0.999	+1.4	-0.26	-0.14
+2	0.9986	-0.4	-0.2	1.000	0	0	0
+1	0.9993	-0.2	-0.1	1.001	-1.4	0.26	0.14
0	1.000	0	0	1.0019	-2.81	0.50	0.28
-1	1.0007	0.2	0.1	1.002	-2.9	0.5	0.29
-2	1.0014	0.4	0.2	1.0025	-3.6	0.64	0.36
-3	1.002	0.5	0.3	1.003	-4.3	0.8	0.43
-4	1.0027	0.7	0.4	1.004	-5.8	1.0	0.58
-5	1.0034	0.9	0.5	1.005	-7.3	1.3	0.73
-6	1.004	1.0	0.6	1.006	-8.8	1.5	0.88
-7	1.005	1.2	0.7	1.007	-10.2	1.8	1.02

-8	1.0055	1.4	0.8	1.008	-11.7	2.05	1.17
-9	1.006	1.6	0.9	1.009	-13.1	2.3	1.31
-10	1.0069	1.8	1.0	1.010	-14.6	2.56	1.46
-12	1.008	2.1	1.2	1.012	-17.5	3.1	1.75

to convert +SMV to s.g.:

s.g. = 1-(SMV x 0.000695) =
negative s.g. 0.9nn...

to convert -SMV to s.g.:

s.g. = 1+SMV x 0.000695) =
positive s.g. 1.0nn...

10 SMV = 1øBaum, =1.8-Plato =0.0069 Sg points

Temp corrections Sg

5C/41F -0.002

Average sake our recipe:

10/50 -0.001

Original gravity estimate:

15/59 -0-

29P/1.133sg/-161 SMV

20/68 +0.001

25/71 +0.002

Table three compiled from various sources: Hough, Briggs, Stevens, Malting and Brewing Science, Chapman & Hall; Amerine, Berg, Cruess, Technology of Wine Making, Avi; and other sources. NOT ACCURATE FOR SCIENTIFIC PURPOSES.

>>>>box<<<<<

THE DOUBLING PROCEDURE EXAMINED:

The process of making Nihonshu/Seishu (Japanese-style refined sake) is complex only so far as one looks at the number of tasks to be performed. The order or sequence of those tasks, each of which is relatively simple, is why it SEEMS complex.

1. The sake finished out at about 19% abv, depending on variables such as rate of polishing, and a lot of other factors. There are no other alcohol ferments which can reach that level in a single step. The closest is sherry, which depends on a "syruped" ferment, where the winemaker adds sugar, as syrup and in small increments, so as not to overwhelm the yeast. This is actually what sake is: an automatic "syruped" ferment--as the aspergillus mold changes the rice starches to fermentable sugars in simple increments the yeast has time to acclimatize itself to those changes. These doubling procedures were all in place by the year 1599! Modernization has changed them only in very small ways: the cultivation of single strain yeasts, and in 1909 the sokujo moto (yeast mash or shubo production (used in this recipe), was introduced to supersede the Yamahai moto method by eliminating the lactobacillus cultivation phase--with the addition of lactic acid to acidify the mash--and thus saving three weeks in the yeast mash portion of the process.
2. The doubling stage system, developed between 600 and 1100c.e., allowed the ferment to develop much higher alcohol levels. Until then one could produce sake only to about 9%abv. This was with a ferment similar to what is called doburoku (home-brewed farm sake). It was, in fact, what we call the yeast mash (shubo) today. Those early brewers found that they could use this initial sake as a starter mash, and then double the mash to start a real ferment, which was doubled again after a day of rest, and doubled twice more (a total of four doublings).
3. Now, for EACH of the above listed 4 phases, one has to polish, wash, steep and steam the rice as we have done in this recipe. The steaming process depends on SEPARATING the grains from the water, thus allowing the steamed rice to be added to a previous mash without clumping. Important to ensure that the mold (and yeast) can reach each grain. The brewer must cool the rice so as not to kill off the yeast or mold activity as it is added to the ferment.
4. This is a 400-year-old continuously used technique, it has REALLY STOOD THE TESTS OF TIME. This a system that has been tested THOROUGHLY BY GENERATIONS AND GENERATIONS OF SKILLED INTELLIGENT PEOPLE.
5. I am contacted regularly by beginning sake makers, mostly homebrewers seeking to cut corners. Some of the recipes on the Internet, and at least one company Vision Brewing of Australia (listed earlier) offers lousy recipes and truly expensive ingredients of dubious origin to make tiny amounts of sake.
6. These are small steps. They are not that troublesome, and they certainly not complicated, just spread out over a long period of time. Annoying perhaps, but not as technically difficult as all-grain brewing.
7. DISCLAIMER: I have no financial interest in any of this, not even for this recipe. I offer it freely. Nor do I have a financial interest in either SakeOne or F.H.Steinbart Co.

(c) 2008 by Fred Eckhardt, all rights reserved.

SAKE BREWING CALENDAR --DAY BY DAY SEQUENCE

MASTER PLAN

Fred Eckhardt, (c) 2008

all rights reserved

May not be reproduced for sale (other than reproduction/distribution costs).

Following are 35 notes to fill out a standard calendar template with 35 day-spaces. Double ***** lines indicate end week space.

Date started _____

1st day (Shubo day -1)

start shubo yeast mash

set water, prep

Wash, steep rice overnight

2nd day (Shubo day 1/7)

AM warm yeast

drain, and steam rice

PM stir

3rd day (Shubo day 2/7)

Stir 2x @ 12-hrs

4th day (Shubo day 3/7)

maintain temp

stir 2x @ 12-hrs

5th day (Shubo day 4/7)

stir 2x @ 12-hrs

6th day (Shubo day 5/7)

stir 2x @ 12-hrs

7th day (Shubo day 6/7)

begin lowering temp

stir once

8th day (end Shubo, day 7/7)

temp 59F/15C

Buildup day -1

PM add koji and water to

yeast mash

wash and steep rice for AM

Date started _____

9th day (Buildup day 1/4)

drain and steam rice

cool shubo to 50F/10C

add shubo to mash

First Addn (Hatsuzoe)

10th day (buildup day 2/4)

Odori ferment

continue stirring @ 12-hrs

PM add koji for next
addition

Wash and steep rice for AM

11th day (buildup 3/4)

middle (naka)

drain, steam rice, for mash

Wash and steep ri for AM

12th Day (Buildup 4/4)

final (tomezoe) addition

drain, steam rice, for mash

add to mash, mix

PM stir @ 12-hr

13th day (Main 1) Moromi

stir @ 12-hr interval

cool to 45F/7C if possible

Date started _____

14th day (Main 2)

stir @ 12-hr intervals

maintain low temperature

take gravity sample

15th day (Main 3) through

maintain temperature

45F/7C - 60F/15.5C

16th day (Main 4)

17th day (Main 5)

18th day (Main 6)

19th day (Main 7)

maintain temperature

take gravity sample

20th - 22d day (Main 8-10)

maintain low temperature

21st day (Main 9)

22nd day (Main 10)

23rd day (Main 11) through

27th day (Main 15)
maintain low temp 45F/7C
if possible to finish.

24th day (Main 12)

25th day (Main 13)

26th day (Main 14)

27th day (Main 15)

Yodan

final rice-water adjustment

Be careful.

Yodan date _____

28th day (Main 16)

29th day (Main 17)

28th - 35th days

(Main 16-23)

final primary

press/rack to secondary

Date _____

31st day to 39th day

Main 19-27, Secondary 1-9

ten days resting

maint temp 45F/7C

40th to 48th day

Main 28-36, Secondary 10-18

date top up _____

Refrigerate

hold for 10 days

49th to 58th day

Main 37-46, Secondary 19-28

Rack, strain and fine

date _____

59th to 80th day

Storage about 20 days

Main 47-68

pasteurize for aging

date _____

WHEN ready

Bottle and finish

pasteurize again

bottling date _____

#####

#####