Report

on

Study and Review of the Existing System of Measurement of Spirits in West Bengal

Submitted to

The Department of Excise

Government of West Bengal

(IIT Kharagpur SRIC Project code: SSRA)

Submitted by

Prof. Debabrata Das and Prof. Subhabrata Ray

Department of Biotechnology

Indian Institute of Technology Kharagpur

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CONTENTS

Executive Summary

This report deals with spirit accounting in West Bengal, focusing on the distilleries and the manufactories. The only distillery in W.B. is unable to supply the ENA requirement for the state and this necessitates import from other states.

Loss of alcohol in distilleries, manufactories and during transport leads to state revenue loss. Such loss can be physical losses or accounting losses due to inexact accounting practices. Improvement of the existing procedure of measurement and accounting of spirit is therefore necessary.

This report reviews the accounting of spirit in West Bengal and has been prepared based on visits to manufactories for CS and IMFL, and the only operating distillery.

This report addresses the remedies to avoid the accounting loss of spirit and includes specific suggestions.

Summary of Recommendations

1. Pilferage from tank lorry in transit

The action by WB Excise on this matter can be -

- On receipt of the tank lorry the hydrometric and temperature measurement of the sample drawn from it should be as accurate as possible.
- The current practice of converting % V/V to LP using a fixed factor should be discontinued. A small computer program may be used locally on a PC to find the correct LP value with input information of the excise pass accompanying a tank lorry.

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2. Loss / gain accounting during transfer, reduction, blending, maturation etc.

Converting the manual system of referring to the calibration charts and the Sykes table to a computer program based system can nearly eliminate potential human errors / inaccuracies and provide accurate values based on the measured parameters. Such a software would consist of sub systems for (1) reading the digitally stored calibration charts, (2) referring to the Sykes Table, (3) computing stocks and stock differences, and (4) computing loss / gain.

3. Obscuration correction

- Samples sent for obscuration assessment must be drawn at the point it is being added to the vat. If bore well water being used is filtered before addition to the vat, it must be sampled from the point of addition and not from the outlet of the bore well.
- Instead of allowing obscuration for bore well water, it is desirable to enforce use of DM water for reduction.
- Quality of the components added may vary from batch to batch. Therefore obscuration correction should be periodically reviewed and revised by sending the samples for evaluation at least once in a year.
- The density of the components added from batch to batch may be checked in the chemical examiner's office using a calibrated hydrometer at a fixed

temperature, say in a 30 ^{o}C constant temperature bath. The obscuration correction would remain same if the density of the sample is lower or equal to the density of the original sample sent for obscuration test.

4. Deficiency

Blending and racking loss may be accounted together.

5. Register formats

The registers are fairly well maintained. Specific changes by deletion of irrelevant columns have been suggested.

6. Use of IS 2302 – 1989 as standard procedure for alcoholometry

This standard is compatible with the international (OIML) standard. Migrating to this standard from other different current practices in different states of India needs to be urged. This will reduce revenue loss of states and also reduce generation of unaccounted spirit that is possibly misused.

7. Computerised spirit accounting system

A computer based accounting system may be adopted with software running in manufactories and distilleries. These modules will communicate with the central database at the State Excise HQ.

The stand alone programs developed by IIT Khargpur for accurate conversion of IS 2302-1962 / IS 2302-1989 to LP may be utilised till the comprehensive software is implemented with the help of National Informatics Centre or any suitable agency.

Glossary

ABV - Alcohol by volume

AL - Alcohol Litres

BIS - Bureau of Indian Standard

BL - Bulk Litres

CS - Country Spirit

DM - Demineralised

ENA - Extra Natural Alcohol

IMFL - Indian Made Foreign Liquor

LP - London Proof

LP - London Proof Litres

OIML - International Organisation of Legal Metrology (*Organisation Internationale de Métrologie Légale)*

OP - Overproof

RSV - Rectified Spirit Vessel

SS - Stainless Steel

SV - Storage Vessel

UP - Underproof

Background

IIT Kharagpur was approached by the Department of Excise, Government of West Bengal, to study and review the system of measurement and accounting of spirit in the state. This study was considered necessary in order to bring out options of overcoming any difficulty and limitations in the existing procedures of accounting, documentation etc. The practices in distilleries and bottling plants (Country sprit and IMFL) come under the purview of this report.

The report aims at review of the practices and suggests the necessary steps that may be taken to address the above mentioned problems.

Methodology

A team from IIT Kharagpur comprising of Prof. D. Das and Prof. S Ray was constituted for the present work. The team along with the officers from the Department of Excise visited the bottling plants (1) M/s Himadri Khan Country Spirit Bottling Plant cum Warehouse in Midnapore, and (2) M/s Essencia Beverages Pvt. Ltd., Howrah (IMFL plant). The team had already visited the starch based distillery of M/s IFB Agro Industry Ltd., Noorpur, South 24 Pgs. During the visits the practice of handling spirit in bottling plants - unloading, reduction, blending, racking, bottling, packaging, storage and dispatch were scrutinized. The distillery operations were scrutinized earlier.

During these visits the Excise related registers maintained in the installations were studied to understand the existing documentation and accounting practices. Discussions with the Excise officers and the officers and staff of the establishment responsible for maintaining the registers were held to have their view on any improvement or changes felt desirable by them.

Copies of the register pages collected during the visits form the basis for the study and verification of figures using the computer program.

The conversion of the different existing measurements of alcohol strength based on IS 2302 – 1962, IS 2302 – 1989 to London Proof (Sykes' Table) have been developed as a conversion algorithm and also a computer program. This is based on the data available in the mentioned codes / Tables and Chemical Engineers' Handbook (5^{th} Ed.) by Perry.

A study of spirit accounting needs to first elucidate the different practices and approaches globally employed for measurement of spirit.

Different approaches for measurement of spirit

1. Measurement of alcohol by ascertaining the strength of the same is an integral part of framing of any policy on alcohol taxation. The principal problems relating to the measurement of strength of alcohol solution have been-

    (i) Mixing of alcohol and water are not additive but a net contraction of volume occurs on mixing.

    (ii) With increasing temperature alcohol expands much more rapidly than water. Thus altering volumetric ratio of the two components.

    (iii) In hydrometric measurements - expansion of the hydrometer bulb with temperature or pressure and deposits on the hydrometer bulb affect the instrument reading.

2. Pure alcohol is almost impossible to obtain as alcohol has a great affinity for water. Even the pure alcohol sold for clinical purpose contains at least five percent water. The systems for determining alcohol strengths are following:

    (i) The methods of proof or proven spirit: The term ‘proof’ or a ‘proven spirit’ is an indicator of alcoholic strength is derived from the early use of gunpowder in testing spirits. With no prior knowledge of the possible strength of a given distillate, the spirit was mixed with gunpowder followed by an attempt to light it. If the mixture did not ignite, the spirit was under proof (too weak); if it lit and burnt steadily with a blue flame this was proof (proven or spoof spirit) of a recognized level of alcoholic strength. However, if it exploded or burnt fiercely, the distillate was reported as over proof and was recommended for further dilution with water.

    (ii) Sykes hydrometer system and Sykes proof law: Invented by an English excise official named Sykes, this hydrometer offered the first accurate method for

testing the strength of spirit or beer. The Sykes hydrometer is based on a very simple law - the law of floatation. This states that a floating body displaces it own weight of liquid. Pure alcohol is lighter than water. If we therefore place a floating body in pure alcohol and then in water it will be found that more of the former is displaced. As mentioned earlier, pure alcohol was impossible to obtain in those days, and this presented a problem for Sykes when he first used the hydrometer. Instead of using 100% alcohol as his standard, he took advantages of the difference in the specific gravity of water and alcohol. He fixed his standard weight to twelve thirteenths of the weight of an equal quantity of distilled water. After calculating it out, by an involved process of mathematics, this means that 100 proof is equal to 57% (an approximate value) alcohol by volume or 175 proof is equal to 100% alcohol.

(iii) The Gay-Lussac system: The French scientist Gay-Lussac applied himself, in 1821-1822, to the study of the relation between liquid and alcohol concentration. He perfected a new alcoholmeter which was easy to use and gave directly, due to its calibration, the alcoholic concentration at a given temperature, and began to manufacture these under his name and reputation. The precision of this new system was at the roof of a new law about wines and spirits in 1824. The Gay-Lussac (GL) system also express percentage volume buy measuring it by hydrometer at 15^0C giving a reading slightly higher than the OIML system.

(iv) Alcoholmeter: The alcohol concentration of the distillate can be determined by measuring its density using a special alcohol hydrometer also known as an alcoholmeter, usually calibrated at 20^0C with reading in % V/V.

The scientific formula to calculate this density is: Density = Weight ÷ Volume.

Alcohol being less dense than water means that the density of a sample of spirit, relative to water, will directly correlate to the volume of alcohol present. If the temperature of the alcohol solution is higher or lower than 20^0C, the density reading will be higher or lower than the true value. The true alcohol concentration at temperatures other than 20^0C can be read on a correction table chart, using the temperature and alcohol concentration range. This hydrometric

method of determining alcohol concentration in distillate is one of the cheapest and simplest to perform with the least chance of error. The purpose of an alcoholmeter is to measure the alcohol percentage in the distillate.

(v) Percentage of pure alcohol by volume (ABV): On the 1st January 1990, the Sykes hydrometer system was abolished under the EEC directive 76/766 and a new system was adopted under which strengths of alcoholic drinks would be expressed as a percentage by volume of alcohol: The OIML system measures this by hydrometer at 20^0C.

Spirit accounting in West Bengal

3. In India Excise activities related to regulation related spirit and its taxation is under the purview of the State Government. The spirit accounting procedure initially followed universally was the Sykes Scale, adopted from the British practice. However this has become obsolete in all European countries from 1st January 1980. Britain has also adopted the spirit strength measurement recommended by the International Organisation of Legal Metrology. The OIML (*Organisation Internationale de Métrologie Légale, OIML*) system measures alcohol strength as a percentage of alcohol by volume at a temperature of 20^0 C. This scale is the same as measuring alcohol to the Gay-Lussac Scale previously used by large part of mainland Europe.

4. Aggregating across all States in India, taxes on liquor contribute around 13% of their total tax revenue. Liquor levies carries higher buoyancies than overall tax revenue, are therefore naturally an attractive sources of collection of revenue for all the states. In case of *West Bengal* in the year 2012-13, excise revenue contributed around 8% of state's own tax revenue.

5. During a span of 5 years i.e., from 2009-10 to 2013-14, production of country spirit increased by almost 75% and in case of Foreign Liquor during the same period, its production has increased by 45%. (Source: Administrative Report 2013-14). In order to produce the amount of portable liquor, West Bengal has to import 495.13 Lakh B.L. of spirit from other states. This is almost 70% of the total requirement of spirit to cater the potable sector in this state. The only operating distillery in West Bengal failed to increase production to the expected level. The production was 233.46 lakhs B.L. in

2011-12 and whereas in 2013-14 the said production was only 222.3 lakh B.L. Therefore the West Bengal State has to *depend largely on importing spirit from outside the state* for supplying potable liquor in the market.

6. Collection of excise duty is directly related to the consumption of liquor from the legal sources. At present the rate of excise duty in case of foreign liquor depends on the declared MRP of each bottle of liquor and in case of country spirit the rate of duty vary . In addition to this, in case of foreign liquor, the sales tax is collected at the rate of 27% on the MRP and in case of country spirit the rate is 20%. An immediate downfall to this steep rate of Government levies is the emergence of a market of untaxed liquor. This untaxed liquor is mainly of two types- (i) one that is produces legally but marketed without payment of government levies and (ii) the other that is produced and distributed illegally.

7. For production of this untaxed liquor the basic raw material of potable liquor i.e. RS or ENA is procured illegally. The import of spirit from other states is being identified as the potent source of this illegal procurement. This is done mainly by pilfered unloading of spirit from the tank trucks carrying imported spirit and also by taking advantage of different accounting procedure of spirit used by different the states in India.

8. The objective of this study is to identify the lacuna of the present system of measurement of alcohol at different stages of use of alcohol in this state, i.e. from receipt of alcohol by way of either import or transport at the manufactories to final production of potable alcohol there and to suggest remedial measures so that the possibility of pilfered draining out of RS or ENA can be detected by measurement of alcohol and can be stopped.

Objectives

The following objectives were set out following the communication from the Department of Excise (Ref. Ltr. No 63(N)-EX(Sanc), dtd. 18/2/2014. Annexure - I)

I. Study and review of the existing system of measurements of spirits in West Bengal
II. Corrective steps to eschew the difficulties in account of receipt of spirit from other account
III. Maintenance of registers
IV. Development of computer applications
V. Wastage calculation procedure for spirits

Development of different approaches for measurement of spirit

9. In the State of West Bengal the legal unit of measurement of strength of spirit is 'London Proof' (L.P.) or Proof and is defined as such a mixture of Alcohol and water at 51^0 F whose weight of 13 parts by volume weighs exactly the weight of 12 parts by volume of distilled water. It is measured by 'Sykes' Hydrometer. The proof spirit thus defined has a density of 0.91984. Such Proof alcohol contains 49.24% by weight of alcohol and 50.76% by weight of water. In terms of volume, such proof alcohol contains 57.06% by volume of alcohol and 46.68% by volume of water making the total 103.74 volumes which in other words means that when alcohol and water is mixed, the result is contraction of volume. Having thus defined Proof Spirit, we may say, that when a spirit has the physical characteristics of 'Proof Spirit', it is 100% Proof. *It may be noted that the BIS Standard IS 6749-1972 uses slightly different numbers. There the proof spirit is specified to have a relative density of 0.91976 at 15.6 ^oC.*

The strength of alcohol in spirit is also expressed in units of % volume by volume and alcohol liter. Some states in India use those units. So, when spirit is imported from those States, these units are to be converted in Proof strength or L.P. The conversion procedures currently followed in the state is as follows:

(a) Percentages volume by volume (% V/V)

When spirit contains 100% alcohol, we say that its strength is 100% V/V or its alcohol content is 100% V/V. Such absolute alcohol is 75.25% over Proof or L.P.

Hence 100% V/V = 175.25% Proof or L.P is the conversion formula.

We have earlier stated that 57.06% V/V alcohol in spirit at 51 ^{o}F is equal 100% Proof.

So, 1% V/V = 100/57.06 Proof

So, 100% V/V = (100 x 100)/57.06 Proof = 175.75^{0} Proof

It is worth mentioning here that the above unitary method of conversion is valid at 51 ^{o}F only. At any other temperature the % V/V would differ due to the different volumetric expansion rates of alcohol and water with temperature change. Therefore, use of the above to interconvert % V/V and Proof is an approximation.

(b) **Alcohol Litre (A.L.)**

Another unit of determining strength of spirit is Alcohol Litre (A.L.)

When spirit contains 100% alcohol, we say its strength is 100% volume by volume. We can also say that its strength is 1 A.L. Thus 100% V/V = 1 A.L.= 175.25^{0} Proof is the conversion formula.

It is clear from above that, 1 (one) is the highest strength of alcohol in spirit in terms of A.L. Hence if strength of spirit is less than 1A.L. then its alcohol contents is less than 100% V/V and its proof strength is also less than 175.25^{0} Proof. If we take the example of whisky in the foregoing paragraph, we find that, 42.8% V/V = 75^{0} Proof = 0.43 A.L. approx.

This is evident from the following calculation –

175.25^{0} P = 1 A.L.

1^{0} P = (1/175.25) A.L.

75^{0}P = 75/175.25= 0.42796 A.L.=0.43 A.L.

Conversion formula used here are -

From %V/V to ^{0}P

(175.25/100) x (%V/V) = 1.7525 x (%V/V)

From ^{0}P to %V/V

(100/175.25) x ^{o}P = 0.5706 x ^{o}P

From ^{0}P to A.L.

(1/175.25) x ^{o}P = 0.05706 x ^{o}P

From A.L. to ^{0}P

175.25 x A.L.= 175.25 x A.L

From A.L to %V/V

100 x A.L.= 100 x A.L.

From V/V to A.L.

(1/100) x %V/V = 0.01 x %V/V

In this case also the above unitary method of conversion is valid at 51 ^{o}F only. At any other temperature the % V/V would differ slightly due to the different volumetric expansion rates of alcohol and water with temperature change. Therefore use of the above to interconvert % V/V, A.L. and Proof is an approximation.

10. Rectified spirit (R.S.) for the purpose of manufacture of potable liquor can be obtained by two means i.e. (a) from distilleries in West Bengal, (b) through import from distilleries of other states. Such R.S. transported to the manufactories is covers by transport pass issued by the Distillery officer and proves the spirit and records the particulars in Register 76 as well as on the reverse side of the transport pass. If there are any deficiencies in the quantity received then such deficiency is computed vis-a-vis allowable limit of wastage as prescribed in rule. The above mentioned calculations are made after receipt of R.S. in the storage vat of the manufactory, where gauging and proving is done before and after receipt of the same.

Spirit accounting in Distillery

11. There is only one operating distillery in the State of West Bengal– M/s IFB Agro Industry Ltd., Noorpur.

The distilled spirit produced and stored in a rectified spirit vessel (RSV) is transferred to the main storage vessel (SV). Tank dips and tank temperatures are noted before and after each operation of the RSV and SV. Sprit samples are also drawn before and after a transfer operation. Spirit strength is ascertained by Sykes hydrometer (Hydrometer – A) after carrying the sample to the DEC's office across the loading bay, which is an air-conditioned space and is usually comparatively cooler. The Sykes reading and sample temperature are noted there.

Ascertaining the quantity of *spirit transferred from RSV to SV* follows the following steps -

Opening and closing stock volumes in the tanks are found from dip of a tank and referring to its excise department approved calibration chart.

Loss/Gain in the transfer (Measured by Volumetric Method.)

Transfer from RSV = Opening Stock (from dip) – Closing stock (from dip)

Receipt in SV = Closing stock (from dip) – Opening stock (from dip)

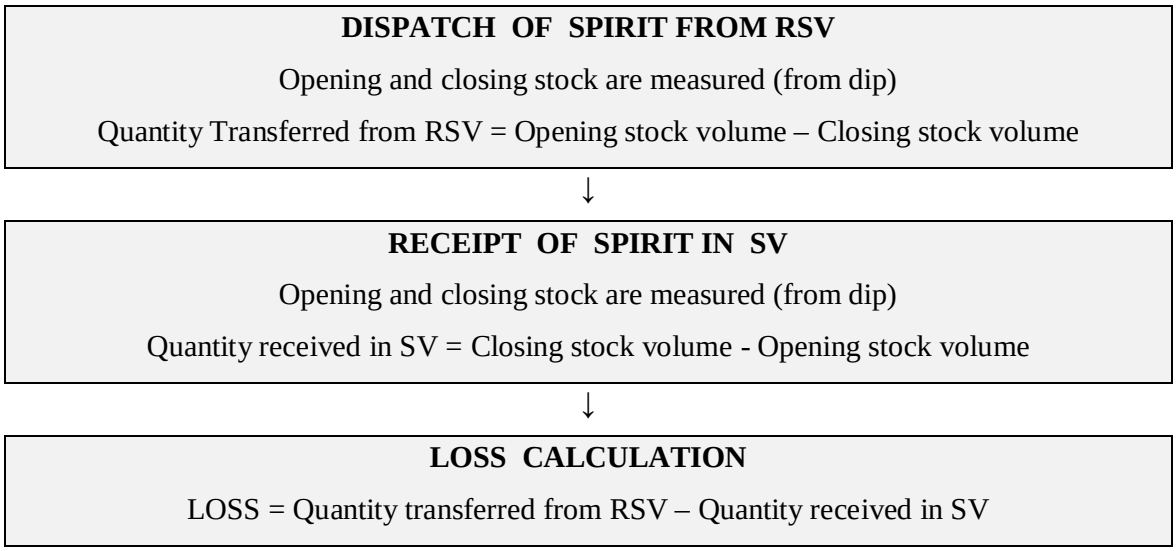
Loss = Transfer – Receipt.

Fig. 1 shows the overview of the process of computing the Loss / Gain.

Loss of alcohol vapour during circulation in tank: Such losses are expected to be higher with higher strength of alcohol i.e. ENA. However even in case of ENA this has been estimated to be very small. Loss of spirit during storage in a tank occurs due to evaporation. There is loss when material is pumped in and out regularly that is when a tank is regularly operated. Based on standard method of estimation of such losses (Method AP 42), and the data for M/S IFB Agro distillery, the estimated loss is around 0.1 to 0.2 % V/V of the transaction.

Apart from the loss of volume due to volatile nature of alcohol, spirit volume changes with temperature. Spirit will not have the same volume if stored at two different temperatures. There is a volume gain, if the final temperature is higher. When temperature of the SSV is higher than the temperature in the SV, actual volume loss due to shrinkage occurs; usually the SSV temperature is expected to be higher since the SSV receives spirit directly from the distillation plant.

Fig.1: Flow chart depicting steps in loss calculation during transfer of spirit from **RSV** to **SV**



NOTE – Measurements done using volumetric method (actual volume).

Transfer of spirit from storage tank (SV) to customer tank lorries

WB Excise has fixed the volumetric carrying capacity of each licensed tanker (keeping only limited vapour space in the compartments). The loaded quantity is verified by the difference in the weight of the tanker at the weighbridge before loading and after loading. The weighbridge has least count of 10 Kg, i.e. the weight recorded is rounded off to the nearest multiple of 10.

Here the measurement of the quantity loaded is done by Weight as against Volumetric in earlier cases.

Operational steps

- A sample is drawn from SV storage tank
- Sample strength is checked in the DEC's office after lapse of some time using Sykes hydrometer and temperature measurement. This reading set is noted under comparatively cooler atmosphere.
- A density is read out corresponding to the Sykes hydrometer reading from a reference table provided to the Distillery by the Excise Department. This table has no reference to the temperature at which the density is being reported. It reads the same density figure as long as the Sykes hydrometer reading is the same irrespective of sample temperature. *Since the density read out corresponds to a hydrometer reading, it is the density of the sample at the temperature at which the hydrometer reading is taken.*
- Quantity in weight (Kg) to be issued to the tanker assuming fixed volume to be loaded each time for the same tanker is calculated by multiplying the fixed volume with the density value from previous step. This density should be the density of the spirit at the temperature at which is being loaded. Whenever the loading temperature is higher than the sample temperature during Sykes reading being taken, the actual density loaded is lower than that used for calculating the Kgs to be loaded. In such a case using a higher value of density results in more weight (Kgs) being advised for loading. Then the tank is loaded with pre-decided quantity (volume).
- After loading the tanker is parked in the open space beside the loading point for 2 to 4 hours. During this period the tanker temperature changes – usually goes up due to standing in the sun. Increase in temperature increases the volume present in the tanker.
- The tanker is placed on the weighbridge for verifying its laden weight against the pre-decided quantity (Kg). Fine adjustments of the quantity (Kgs) loaded is done by manually loading / unloading using bucket.

Accounting

- Before starting the spirit issue, initial dip of the SV tank and spirit volume is decided with the help of the Excise approved gauging table. The accuracy of tank dip measurement is +/- 1 mm, and over a reasonably large number of transaction, the error is expected to cancel out as it can be positive as well as negative.
- After completion of loading of the tankers, dip of the tanker is taken and the quantity leftover in the SV is calculated with the help of the gauging table.

- The quantity loaded in the tankers is measured in Kg and then converted into volume in litres, using the density found out at the beginning of the process of issue.
- The volume of all tankers is added and taken as a total quantity issued.
- The quantity issued which is determined as mentioned above is subtracted from the opening stock of the tank. (This combines the volumetric and weight measurement system)
- The balance is taken as a closing stock. This is compared with the closing stock of the tank determined by dip measurement
- The difference in closing stock by dip measurement and the quantity arrived by subtracting quantity issued to the tankers from opening stock is taken as a loss or gain.

Spirit accounting in manufactory

12. Spirit strength of degree OP is transferred to vat for dilution with water for the purpose of reducing its strength to 50 degree UP, 60 degree UP, 70 degree UP or 80 degree UP in case of country spirit and 25 & 50 degree UP in case of foreign liquor. Each and every vat of storing spirit for each strength has individual Register 74 where full particulars of a vat's transaction is written day to day immediately after each transaction. For reduction purpose water is used after its obscuration is determined by the Chemical Examiner. So in every case of gauging and proving the strength of reduced spirit the obscuration has to be deduction from the final strength determined by Sykes Hydrometer Table. After reduction and maturation as stated above the particular strength of C.S. is issued to the bottling line. Total transactions of spirit either in bulk or in bottles is recorded in Register 78. Register 78 gives the balance account of spirit in hand and summary of transaction in a manufactory.

    In case of manufacture of foreign liquor before bottling there is another process of manufacturing called blending. For this purpose, spirit is issued from the SS vat to Blending vat. Once the transfer is complete, spirit in both the SS vat and the blending vat are allowed to settle for a reasonable period of time (5-6 hrs). After this transfer, HBS or Malt spirit as per requirement of the licensee is added. After that, water is added to the spirit in blending vat as to reduce the strength of the spirit from OP to UP. The quantity of water to be added is calculated on the basis of the desired strength of

the final product e.g. 25 degree UP or 50 degree UP. While adding water the licensee adds colouring and flavouring agent (non alcoholic product) into the vat as per their convenience and regulations. Then the content of the vat is allowed to be blended mechanically and strength of the spirit is maintained at the prescribed limit by adding exact quantity of water. Then the content is allowed for maturation for certain period (few days).

It is noticed that before or after transfer of spirit from each vat the volume of alcohol is measured in London proof litre by ascertaining the strength of alcohol in each vat by using Sykes hydrometer. The dip of the concern vat is taken by using Dip Rod / Dip Tape and the net volume of the spirit in BL is ascertained by using this data with the corresponding calibration chart for the vat. Then total volume of spirit in LPL is calculated by multiplying the ascertained volume in BL and the receipt strength.

13. During manufacture of potable alcohol any wastage or increase of alcohol in noted. It is found that there are following kinds of such wastage or increase-

(i) The wastage in transit or increase in transit as the case may be, has to be determined and noted (in case of transit loss), to see if the wastage is within the allowable limit or has exceeded the allowable limit. – This is the difference of the spirit received in a vat after unloading and the quantity recorded in the pass accompanying the transport vehicle.

(ii) In case of any deficiency where two separate strength of spirit is mixed, it is equally divided between the heads of ”Blending” and “Racking”. If the amount is not equal the larger portion must be entered under the head “racking” deficiency, e.g. if a total deficiencies is 1.5 L.P.L. it would be entered as 0.8 under racking and 0.7 as blending deficiencies. *However no logic for the same is apparent and this appears to be an age old practice.*

(iii) Before the transfer of any O.P spirit from the strong spirit vat, the content should be gauged an proved and if any deficiency is noticed it should be accounted as the “storage wastage” and accordingly the result is to be noted in the concerned vat register (Register 74)

(iv) At the end of day’s bottling operation, the total number of bottles of potable liquor produced is to be accounted for and if any deficiency is noticed with

regards to the total quantity of spirit removed for bottling vis-a-vis total quantity of bottled C.S. obtained, the deficiency should be recorded under the head "bottling wastage".

Note: (i) In case of country spirit bottling plants total wastage towards storage, blending, racking and reduction is to be compared with allowance @ 1.5% on total quantity of proof spirit handled during the period of inspection. Total wastage found during bottling (the difference between quantity of spirit removed for bottling after reduction and the quantity of spirit received after completion of bottling) is to be compared with allowable allowance @2% V/V on total quantity of spirit removed for bottling.

(ii) In case of foreign liquor manufactory, if the wastage in proof litres exceed [1%V/V] of the total quantity of potable foreign liquor in proof litre handled in the quarter, the licensee shall be required to pay duty and fee in respect of such deficiency at the highest rate of duty and fee applicable to potable foreign liquor within seven days on demand.

Secondly, whenever the wastage in proof litres exceeds [1%] of the total quantity of potable foreign liquor in proof litre handled in the quarter, the licensee shall be requied to pay duty and fee in respect of such deficiency at the highest rate of duty and fee applicable to potable foreign liquor.

14. **Registers maintained in the manufactories** are -

(i) Register in form No.-76 – Receipt Register

(ii) Register in form No.- 74 – Individual vat register

(iii) Register in form No.- 78 – Daily summary of transactions

(iv) Register in form No.- 90 – Warehouse supply to retail transactions

(v) Register A – Accounting of reduction vat

(vi) Register B – Bottle stock register

15. Receipt of spirit

In the State of West Bengal, spirit-Extra Neutral Alcohol or Grain Extra Neutral alcohol are received in the manufactories either by way of import or by way of transport. It is seen that the most in the imports are form Uttar Pradesh, Punjab and

Jharkhand. Each case, the Import Permit-cum-Passes are issued by the Excise Commissioner with description of articles in the following manner -

Extra Neutral Alcohol- IS:6613(2002), strength-minimum 96% v/v at 20 ^{o}C, Maximum specific Gravity- 0.80692 at 22 ^{o}C. In case of Grain ENA , the Import Permit description of article is given as Grain ENA, IS:6613-2002, strength 68.2^{0} OP. In case of import from Uttar Pradesh the excise of the said state at the time of allowing the export of ENA on the export pass mentions that the strength of the spirit is used to be 96% v/v. In the certificate issued by the officer of the exporting distillery, it is mentioned that the strength of the Extra Neutral Alcohol mentioned on export passes 95.5% V/V at 30.5^{0}C and 99.9^{0} alcoholometer indication (as per IS table No.- 2302-1962 reference temperature for 15^{0}C is equivalent at 96.1% v/v as per IS table no,-2302-1989, reference temperature for 20^{0}C).

In case of import form Jharkhand it is mentioned on the export passes that the strength of the spirit is 68.2 OP. In case of import from Punjab the strength of spirit mentioned as 68.4 OP. In case of transport of spirit from IFB, Noorpur, West Bengal in a particular case it is found that the strength of the spirit issued from the said distillery is 69.1^{0} Over Proof. In case of Uttar Pradesh where from most of the import is reported used to measure the strength in alcoholometer. In rest of the cases the strength was measured in Sykes Hydrometer. Both in the case of Jharkhand and Punjab there are reference of the temperature at which the said strength of the spirit have been reported.

16. Problems in the present system

Distillary Problems and Recommendations to avert those

The procedure of accounting followed in the distillery has already been outlined in Para 11.

Problems

Unaccounted Despatch : The loading advice is prepared in volume but the final loaded amount is checked against a calculated laden weight for the tank lorry. This calculation involves density of the spirit being loaded being measured by Sykes

hydrometer and a conversion chart to read out kg/litre against Sykes hydrometer reading. A difference between the loaded spirit temperature and the temperature at which the hydrometer measurement is noted introduces an error. Usually the sample cools down and attains a lower temperature. Based on 68 OP sprit being the average quality, if the loading temperature is 1 ^{o}C higher this leads to unaccounted extra despatch of around 0.073% i.e. against a loading advice volume of 20000 lits, an extra 14 to 15 litres will leave the distillery unaccounted. This unaccounted volume will be more if the temperature difference is even higher. Over a monthly despatch the quantity would be in hundreds of litres for which there is every chance of this unaccounted spirit being used for illicit liquor manufacture leading to revenue loss.

Unsafe practice of overloading tank lorry: It is noted that the tank lorry loading advice quantity is beyond the maximum limit specified in the calibration record issued by the Department of Weights and Measures. This violates statutory rules and is unsafe during transport.

Recommendation to avert the problem

(i) The present arrangement of combining volumetric measurement with weight based system should be discontinued and the tank lorry loading and its accounting should be based on volume (BL and LPL) only.

Till the above is implemented, Kgs to be loaded in the tank lorry may be found out by using the hydrometer for IS 2302:1989. The 'Indian Standard Tables for Alcoholometry by Hydrometer Method' (IS 2302:1989 – Reaffirmed 2001), is in line with the international practices and is used in several other states. Using this IS Code one can correctly estimate the 'Litres per 100 Kg' corresponding to the hydrometer reading at the temperature at which it is noted. It is needless to say that the hydrometer reading of the sample should be taken immediately after the same is drawn and before any perceptible temperature change occurs.

(ii) The loading advice volume must be restricted to the capacity indicated in the calibration chart for each tank lorry.

Manufactory Problems and Recommendations to avert those Problems

(i) Quantity of spirit received by tank lorry (import).

The quantity entered in the excise accompanying the tank lorry is taken as the amount loaded in the tank lorry.

Receipt from West Bengal, Jharkhand and Punjab

Pass entries for tank lorries from within the state, from Jharkhand and Punjab contain entries for spirit strength in the OP, quantity in bulk litres, temperature and other details already mentioned earlier (Para 15). Receipt of spirit from these sources having same scale of strength measurement (Sykes) as in this state gives rise to least accounting problems. The quantity of spirit unloaded from the tank lorry and received in the receiving vat is found from the measured (dip, Sykes hydrometer reading and temperature) stock difference in BL as well as LPL. Difference between the receipt and the excise pass document is considered as transit loss or gain.

Strength of the spirit samples from the tank lorry are also measured on arrival at the manufactory. While going through the excise documents it was noted that in some cases the measured strength of the OP spirit on arrival was higher than that noted on the accompanying excise pass. *This leaves scope for pilferage in transit and making up the pilfered volume with water. Also if this goes undetected during receipt at the manufactory, this would lead to extra LPL received in the manufactory and there is possibility of misuse of this spirit and the government losing the revenue.*

Receipt from UP

UP follows the system of alcoholometry as per IS 2302-1962. In the certificate issued by the officer of the exporting distillery, it is mentioned that the strength of the Extra Neutral Alcohol mentioned on export passes 95.5% V/V at 30.5^0C and 99.9^0 alcoholometer indication (as per IS table No.- 2302-1962 reference temperature for 15^0C is equivalent at 96.1% v/v as per IS table no,- 2302-1989, reference temperature for 20^0C).

The current approximation practice to convert %V/V to LP is by multiplying the %V/V value with 1.7525 as has already discussed earlier (Para 9). Corresponding to 95.5 % V/V value at 30.5^0C and 99.9^0 alcoholometer indication it is 67.4 OP. Following a rigorous conversion procedure, the same alcohol has strength of 70 OP. This shows that the current practice assesses the spirit strength to be lower than the actual value. *This leaves scope for pilferage in transit and making up the pilfered volume with water. Also If this goes undetected during receipt at the manufactory, this would lead to extra LPL received and there is possibility of misuse of this spirit and the government losing the revenue.*

Though there were no documents corresponding to ENA receipt where the excise pass mentions use of IS 2302-1989, reference temperature 20^0C, but the same observation is applicable in that case too.

Recommendation to avert the problems

It is not possible to correct any unintentional or intentional errors and omissions in the entries of the excise pass accompanying an import. Recording of lower than actual OP strength on the pass opens up the scope for transit pilferage as well as receipt of unaccounted spirit in a manufactory. This is suspected as there have been cases of more LPL receipt in manufactories (i.e. gain) than that recorded in the excise pass. This directly leads to loss of revenue for the exporting state and increases the scope of illicit liquor market.

The action by WB Excise in this matter can be -

- On receipt of the tank lorry the hydrometric and temperature measurement of the sample drawn from it should be <u>as accurate as possible</u>. A small computer program may be used locally on a PC to find the correct LP value. Inputs to this program shall be the Sykes hydrometer reading, temperature noting and corrections, if any. These corrections to the readings of the hydrometer and thermometer are known from the respective calibration document. This would reduce possibility of human error in reading the Sykes tables.

- The current practice of converting % V/V to LP using a fixed factor should be discontinued. Computer programs for accurate conversion of the hydrometer readings and corresponding temperature (documented in the excise pass) to LP should be used. The programs would be different for excise pass as per IS 2302-1962 and IS 2302-1962. This would assess the correct LP instead of its approximation and the effect will be accurate accounting and greater control on ENA input to the manufactory.

(ii) Loss / gain accounting during transfer, reduction, blending, maturation etc.

The procedure for estimation of loss/gain in a manufactory is outlined earlier (Para 13). There the sub-items ii, ii and iv specifically pertain to transfer, reduction, blending, maturation.

Storage loss – The computation of the loss / gain at present is based on a manual system of noting the stocks against the tank dips, and ascertaining the strength is based on the noted Sykes hydrometer reading and sample temperature. The computed figure depends on accuracy/ correctness of the measured parameters (dip, hydrometer reading, and temperatures). It is however noted that standard operating practice is followed for these measurements. Inaccuracies / error may creep in during manually computing the LP by referring to the Sykes table and noting the stock against the calibration chart.

Recommendation to avert the problems

Converting the manual system of referring to the calibration charts and the Sykes table to a computer program based system can nearly eliminate potential human errors / inaccuracies and provide accurate values based on the measured parameters. Such a system would consist of sub systems for (1) reading the digitally stored calibration charts, (2) referring to the Sykes table, and (3) computing stocks and stock differences. (4) computing loss / gain.

(iii)Measurement of LP using Sykes hydrometer – 'obscuration' effect correction

IS 6749 defines the term '**Obscuration**'as follows : The difference caused by matter in solution (or suspension in a colloidal state) between the strength of spirit and the apparent strength as indicated by the hydrometer or other instrument for recording alcoholic strength.

Apparent loss of strength due to dilution with water containing dissolved / colloidal solids or mixing of any other ingredient like other alcohol stock, syrup, caramel, colouring agent etc that may contain dissolved / colloidal solids result in 'obscuration'.

Obscuration correction is experimentally determined. Such correction value in terms of the change of hydrometer reading is specific to a range of alcohol formulation. It is also for mixing of specific components of a mix only in a range of proportion i.e. around the variations for a typical formulation of spirit blend. At least one of the component stocks must contain dissolved / colloidal solid. As the solid density is more than water the hydrometer floats up more and apparently shows a weaker strength of spirit. Therefore, *after the 'obscuration' correction the corrected result shows higher concentration of alcohol*.

Typically the actual alcohol content in the blend is found out by the test procedure specified in the Lab Manual #16 for Methods for Analysis of Foods – Alcoholic beverages published by Food and Standards Authority of India, GOI, New Delhi. Based on the alcohol content, the Obscuration is found by comparing the LP measurement of the blend and the LP of a blend of pure ethanol and pure water containing the same alcohol fraction.

Demineralised water (DM water) used for spirit strength reduction contains no solid – it is pure water. Therefore the obscuration correction in reducing ENA with DM water is 'zero' i.e. there is no correction required.

In case of CS a typical obscuration from the document was found to be 0.2 while using bore well water that possibly contained dissolved salts. The same for a sample of Rum was 1.75.

It is shown in the calculations presented in Annexure – 1 that obscuration correction of 0.2 LP corresponds to change in the 4^{th} place after decimal in the sample density (in gm/ml) and that is detectable. Using hydrometry, density is reported up to the 5^{th} place after decimal.

Obscuration correction for water and other blend are experimentally determined using samples of these. Any incorrect sampling with a higher dissolved / colloidal solid will result in a larger obscuration effect being recorded and used in the manufactory. This would lead to revenue loss.

Recommendation to avert the problems

- Samples sent for obscuration assessment must be drawn at the point it is being added to the vat. If bore well water being used is filtered before addition to the vat, it must be sampled from the point of addition and not from the outlet of the bore well.
- Instead of allowing obscuration for bore well water, it is desirable to enforce use of DM water for reduction.
- Quality of the components added may vary from batch to batch. Therefore obscuration correction should be periodically reviewed and revised by sending the samples for evaluation.
- The density of the components added from batch to batch may be checked in the chemical examiner's office using a calibrated hydrometer at a fixed temperature, say in a 30 ^{o}C constant temperature bath. The obscuration correction would remain same if the density of the sample is lower or equal to the density of the original sample sent for obscuration test.

(iv) Blending and Racking Loss

Traditionally the 'blending and racking' losses have been notionally apportioned and this creates an unnecessary accounting step.

Recommendation to avert the problems

The blending and racking loss can be combined under a single head. This will have no effect on the loss accounting.

(v) Register Formats

The entries in the excise register forms contain several heads. It was noted in the distillery as well as the manufactories visited that there are several columns that are not relevant and filled any more. Revised Form column entries are shown in Annexure - 2

Recommendation to avert the problems

The irrelevant heads may be deleted. In fact these registers should be converted to electronic forms with the help of an institution like the NIC or TCS or Infosys. Such a system should be web based, allowing monitoring from the W.B. State Excise HQ.

17. Recommendation of general nature

Adopting IS 2302-1989 as the standard procedure for alcoholometry by all states

Presently the states in India employ three basic methods of alcoholometry. Each of these are based on hydrometer measurements. This has already been discussed earlier (Para 15) and are noted to be the Sykes Table, IS 2302- 1962 and IS 2302 – 1989. Presence of three different measurements of spirit strength requires inter-conversion of the strength scales during interstate bulk transfers. The present practice of spirit strength interconversion uses conversion factors and is approximate. This had been adopted to keep the calculations

simple and for ease of manual implementation. Such approximate accounting however leaves out a part of the spirit consignment unaccounted. In several batches of import for other states where strength conversion was involved, documents show short receipt in BL without such an effect on LPL receipt at the destination. This suggests that the lacuna in interconversion is being exploited by unscrupulous transporters and / or manufactories and the unaccounted spirit is misused.

The above leads to loss of revenue of the state and generation of unaccounted spirit that is possibly misused. The misused spirit used in making illicit liquor is a societal hazard too. It is only possible to ensure the correctness of the strength and loaded quantity noted at the point of despatch by the excise authority of the exporting state. As such the exporting state would always try to ensure this, else they lose revenue. The present lacuna in interconversion has now opened up a scope for upgrading the alcoholometry method in all the states and universally adopt IS 2302-1989 as the applicable standard.

Adopting IS 2302-1989 universally will have the following advantages –

- Loss of revenue by the exporting and the importing states due to approximate accounting can be eliminated.
- Compatibility with the international standard - IS 2302-1989 is compatible with OIML standard and uses $20^{o}C$ as the reference temperature. This brings in compatibility in case of most international trade transaction.
- Accounting calculations and record keeping gets much simplified.

Adopting computer based system of accounting

The present accounting process in a distillery or in a manufactory is based on manual record keeping in certain set Forms with specific identification (Nos. 76, 74, 78, 90, A, B). These are maintained in the form of Registers.

Filling up these forms and related calculations require the following input data -

a) Sykes hydrometry results –
    - Hydrometer reading and calibration correction (if any) for the specific hydrometer used

- Sample temperature read by the thermometer and calibration correction (if any) for the specific thermometer used

b) Stock in a tank or Vat
   - Tank or vat identification
   - Status - Opening stock or Closing stock
   - Time of Dipping
   - Dip, Tank Temperature
   - Sykes hydrometry results on tank sample drawn
     - Hydrometer reading and calibration correction (if any) for the specific hydrometer used
     - Sample temperature read by the thermometer and calibration correction (if any) for the specific thermometer used

c) Receipt in Vat

   Tank or Vat identification

   Source of receipt – Tank lorry unloading / Vat no.

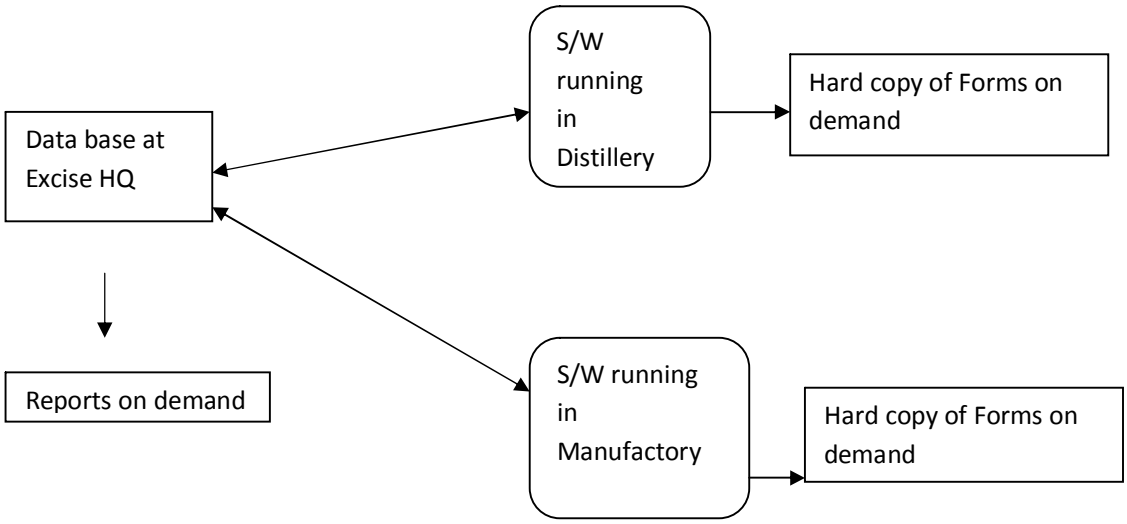
d) Despatch from vat

   Tank or vat identification

   Destination of despatch – Tank lorry loading / Bottling / Vat no.

Structure of such software that can cater to the need of Distilleries as well as the Manufactories has to be modular. The software should communicate with a central data base at WB Excise HQ i.e. there will be installed software in the Manufactories and Distilleries. The locally installed software will maintain all Excise Registers (Forms) and provide print out of reports on demand. They will which will update data at the central data base through web.

Overview of the computer support system



The software in the Manufactory / Distillery may be developed following basic modules – IMPORT, REDUCTION, BLENDING, BOTTLING, BOTTLED STOCK.

These basic modules will be interlinked to generate the various register entries. A local database would store the information and will be used for printing on demand the hard copy of the register records. The modules and their details are mentioned in Annexure – 2.

It may be noted that the presented preliminary concept details are for the current practice based on Sykes table. In case of IS 2302 – 1989 being universally adopted by the states, the strength conversion sub-module will not be used as all the quantities will be in BL and AL.

Computer programs

18. Computer programs

Conversion of the spirit strength information available on excise pass accompanying the tank lorry is required whenever the import is from a state that does not use Sykes Table. This calls for computer programs to convert the IS 2302-1962 and IS2302-1989 measurements (alcohol richness and real strength) to PL.

Two computer programs have been developed on the basis of the detailed scientific steps and are presented below as algorithms. Sample outputs from these programs are provided in Annexure – 3A and 3B.

Algorithms

When the exporting state uses IS2302-1962

Input: Temperature (T ^{o}C), and Hydrometer Reading (H)

Step1: Look up IS 2302-1962 Table I corresponding to H and T and note 'Corresponding ^{o} at 15 ^{o}C'. Call this H15.

H15=100 x volume of ethanol in sample / volume of sample at T^{o}C.

Step 2: Look up IS 2302-1962 Table II corresponding to H15 and read (from the 3rd column) the Density (gm/cc in vacuum) of sample at 15 ^{o}C'. Call this D15.

Step3: Compute %w/w ethanol in sample, pctwt = (H15 x 0.79360) /(D15). Density of pure ethanol at 15^{o}C, 0.79360 gm/cc, is noted from Chemical Engineers Handbook (5th Ed.) by Perry.

Step 4: Look up Table T3-129, in pg 3-83 of Chemical Engineers Handbook (5th Ed.) by Perry for density (gm/cc in vacuum) of the sample at 10.56 ^{o}C (51 ^{o}F) corresponding to pctwt. Call this D51F. Interpolation within the table may be necessary.

Step 5: Compute %v/v of ethanol in sample at 51 ^{o}F (10.56 ^{o}C), vpct51f.

vpct51f=D51F*pctwt/0.7973736;

Where, 0.7973736 gm/cc is pure ethanol density @51^{o}F.

Step 6: Compute London Proof, LP = vpct51f/57.06; Considering 100 LP is equivalent to 57.06 %v/v ethanol mixed with pure water at 51^{o}F (10.56^{o}C).

Output: ^{o}OP or ^{o}UP is computed from LP. If LP is above 100, the difference between LP and 100 is OP, else it is UP.

When the exporting state uses IS2302-1989

Step1: Look up IS 2302-1989 Table I corresponding to H and T and note 'Corresponding ^{o} at 20 ^{o}C'. Call this H20.

H20=100 x volume of ethanol in sample / volume of sample at T^{o}C.

Step 2: Look up 'Litres per 100 kg' corresponding to HT, from Table 1 bottom row. Call this lp100kg.

Step3: Compute %w/w ethanol in sample, pctwt = H20 x lp100kg x 0.78924 /100.

Density of pure ethanol at 20^{o}C, 0.78924 gm/cc is obtained from Pg 3 of IS2302-1989

.Step 4: Look up Table T3-129, in pg 3-83 of Chemical Engineers Handbook (5th Ed.) by Perry for density (gm/cc in vacuum) of the sample at 10.56 ^{o}C (51 ^{o}F) corresponding to pctwt. Call this D51F. Interpolation within the table may be necessary.

Step 5: Compute %v/v of ethanol in sample at 51 ^{o}F (10.56 ^{o}C), vpct51f.

vpct51f=D51F*pctwt/0.7973736;

Where 0.7973736 gm/cc is pure ethanol density @51^{o}F.

Step 6: Compute London Proof, LP = vpct51f/57.06; Considering 100 LP is equivalent to 57.06 %v/v ethanol mixed with pure water at 51^{o}F (10.56^{o}C).

Output: ^{o}OP or ^{o}UP is computed from LP. If LP is above 100, the difference between LP and 100 is OP, else it is UP.

The above two measurement conversion algorithms have been put in the form of two separate computer programs.

Options:

In case of exporting state excise department using IS2302-1962, they may be requested to mention on their pass document strength %V/V @$15^{o}/15^{o}$C and a Conversion Table of %V/V @$15^{o}/15^{o}$C to LP can be provided.

&

In case of exporting state excise department using IS2302-1989, they may be requested to mention on their pass document strength %V/V @$20^{o}/20^{o}$C and a Conversion Table of %V/V @$15^{o}/15^{o}$C to LP can be provided.

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Annexure – I

A sample calculation to evaluate if <u>obscuration</u> of 0.2 LP is detectable by hydrometer

The obscuration depends on the blend components and the concentration of alcohol present in the sample. The observed LP of a sample best on the Sykes' table is corrected to the actual LP by addition of the 'obscuration' and the same is used for computing the LPL of spirit stock.

In case of CS typical obscuration from the document was found to be 0.2, and the same for a sample of Rum was 1.75.

Correction due to obscuration –

Say in a typical case of CS the observed value is 60 ^{o}UP => 40^{o} LP is the observed LP. If obscuration is 0.2 LP, the actual LP will be 40.2.

Basis: 100 LP = 57.06%v/v at 51 ^{o}F (10.56^{o}C)

From Chem Engrs. Handbook – Perry, 5th Ed.

Ethanol density @10.56^{o}C= 0.7973736 gm/cc

Density of water at 10.56^{o}C= 0.999675 gm/cc

% v/v ethanol in 40^{o} LP sample at 10.56 ^{o}C = 0.4 x 57.06 = 22.824

% v/v ethanol in 40.2^{o} LP sample at 10.56 ^{o}C = 0.402 x 57.06 = 22.93812

%w/w ethanol in 40^{o} LP sample = 100 x 0.7973736 x 22.824 /
(0.7973736 x 22.824 +(100-22.824) x 0.999675)
= 19.0867362

%w/w ethanol in 40.2^{o} LP sample = 100 x 0.7973736 x 22.93812/
(0.7973736x22.93812+(100-22.93812)x0.999675)
= 19.1868356

From Chem Engrs. Handbook – Perry, 5th Ed.

Density of 19%w/w ethanol at 30^{o}C = 0.96547 gm/cc

Density of 20%w/w ethanol at 30^oC = 0.96395 gm/cc

Density of 40^o LP sample (19.0867362 %w/w ethanol) at 30^oC = 0.965338161 gm/cc

Density of 40.2^o LP sample (19.0867362 %w/w ethanol) at 30^oC = 0.96518601 gm/cc

The difference in density due to the obscuration effect is in the 4^{th} place after decimal in the density measurement. *Spirit density measurements are reported up to 5 places after decimal and hence an obscuration of 0.2 LP will be detectable by hydrometers and needs to be corrected for. Higher obscurations found in case of IMFL certainly need to be corrected as well. In short all non-zero obscuration corrections need to be incorporated while accounting spirit.*

Annexure – II

Revised Formats for Forms

Register of Spirit Received into, reduced or blended in, and issued from, each Vat or Store Cask at_____Distillery/Warehouse
West Bengal Form No. 498
West Bengal Excise Form No. 74
Vat No.

1. Date and hour	
BALANCE IN HAND FOUND BY ACTUAL GAUGING AND PROVING	
2. Dip. in wet (cm)	
3. Temperature (^oF)	
4. Sykes Indication	
5. Strength	
6. Bulk litres	
7. L.P. litres	
8. From which receiver	
RECEIPTS	
9. Bulk litres	
10. L.P. Litres	
11. From which Vat	
12. Total number of casks or drums	
13. Bulk Litres	
TOTAL IN HAND AND RECEIVED	
14. L.P Litres	
15. Bulk litres	
16. L.P. Litres	
17. Increase L.P. Litres	
DEFICIENCIES (L.P. LITRES)	
18. Total	
ISSUES	
Under Bond:	
19. Storage	
20. Destination	
21. Bulk Litres	
On payment of duty:	
22. L.P. Litres	
23. Bulk litres (total of quantities actually measured out)	
24. L.P. Litres	
Transfer to other Vat or total number of cask or drums:	
25. Bulk litres	
26. L.P. Litres	
27. Number of Vat or total number of cask or drums	
28. Remarks (Nature of operations to be noted in this column)	
29. Initials	

Annexure – II

Drums received and of Spirits issued therefrom
West Bengal Form No. 500
West Bengal Excise Form No. 76
Register No. 76-Register of Casks and Metal

1. Import Permit No.:-	
2. Name of the exporting Distillery:-	
3. Date of arrival (DD/MM/YY): Date of receipt (DD/MM/YY):	
4. Date of Examinations (DD/MM/YY):	
5. Export Order No. & Date:-	
6. Export Pass No. & Date:-	
7. Details of Advised Quantity (BL,AL,LPL)	
Dip (cm)	
Temperature (^{o}C/^{o}F)	
Indications	
Strength (LP)	
8. Detailed of Receipt Quantity (LPL)	
Dip (cm)(BL & LPL)	
Temperature (^{o}C/^{o}F)	
Indications	
Strength (LP)	
9. No. of days in transit	
10.Transit wastage	
11.Tanker unloaded & stored in vat no.	
12.Motor Vehicle registration No.	
13.Way Bill No.	
14.Endorsement date in Way bill	
15.Invoice No. & Date	
16.Specific Gravity and Temperature	
17.Registered unloaden weight (as per R/c)	
18.Registered laden weight (as per R/c)	
Volume/Capacity (BL)	
19.Actual unloaden weight (as per T.P) (Kg)	
20.Actual Laden weight (as per T.P) (Kg)	
Volume/Capacity (BL):-	
21.Volume as per Calibration certificate (BL)	
22.Dip reading & capacity as per Calibration certificate(cm/BL)	
23. (a) Way Bill No. (as per T.P.)	
(b) Way Bill No.:-	
(c) Tanker No. (As mentioned in export pass):-	
(d) Tanker No.(As per mentioned in way bill):-	
(e) Tanker No. (as per mentioned in invoice):-	

Annexure – II

Balance Account of spirit in hand and summary of transactions
at Warehouse district: Month of 201
Month of 200
West Bengal Form No.- 502
West Bengal Excise form No. 78

BALANCE ACCOUNT (LPL)	
1. Date	
2. Balance in hand	
3. From receiver	
4. Quantity as advised on despatch account from distillery or warehouse	
Increase	
5. In transit	
6. In operation	
7. By gorging	
8. Total of columns 2 to 7	
9. Date	
Issues	
Under bond or duty free:	
10. To ware house	
11. For denaturation or other purposes as stated in remarks column	
12.On payment of duty	
13. Deficiencies	
14. Excess deficiencies included in preceding columns, but reported for duty to be charged	
15. Quantity of spirit reduced or blended (prior to operation) in L.P. Litres	
SUMMARY OF TRANSACTION (LPL)	
Issues to vendors at the under mentioned nominal strength	
16. U.P. (LPL)	
17. Total duty paid (Rs.)	
18. Amount of cost price due to the contractor (Rs.)	
19. Remarks	
20. Initials	

Annexure – II

Register A
Bottling of spirit

District : 24 Parganas (North)

Nominal Strength: 50^{o} UP

1. Batch No. & Date	
2. Receipts	
(a) From Vat No.	
(b) Strength	
(c) Bulk Lts.	
(d) Proof Lts.	
3.	
(a) 600 ml	
(b) 300 ml.	
(c) Proof Lts.	
4. Removed to stores	
(a) 600 ml	
(b) 300 ml.	
(c) 200 ml.	
(d) 375 ml.	
(e) Bulk Lts.	
(f) Proof Lts.	
5. Increase	
6. Deficiency	
7. Remarks	
8. Dated Initial of Excise Officer	

ANNEXURE-II

Register B

Stock Bottle Country Spirit
Nominal Strength: UP
Quantity per bottle:

1. Date	
2. OPENING BALANCE	
50° UP: 600ML	
50° UP: 300 ML	
B.L	
L.P.L	
T.P. No. & Date Batch No.	
3. QUANTITY ADVISED/ RECEIVED IN STORE	
50° UP: 600ML	
50° UP: 300 ML	
B.L	
L.P.L	
4. TRANSIT WASTAGE	
50° UP: 600ML	
50° UP: 300 ML	
B.L	
L.P.L	
5. ACCOUNTED	
50° UP: 600ML	
50° UP: 300 ML	
B.L	
L.P.L	
6. QUANTITY ISSUED	
50° UP: 600ML	
50° UP: 300 ML	
B.L	
L.P.L	
7. STORAGE WASTAGE	
50° UP: 600ML	
50° UP: 300 ML	
B.L	
L.P.L	
8. CLOSING BALANCE	
50° UP: 600ML	
50° UP: 300 ML	
B.L	
L.P.L	
9. Signature	
10. Remarks	

Annexure – IIIA

Sample output : Strength conversion program – IS 2302 – 1962 to LP

Program for IS2302-1962 Table 1 developed by IIT Kgp

Inputs

(1) Hydrometer reading HT at sample temperature (T deg C)

HT can be between 90 and 103

HT must be a multiple of 0.1; 89.97, 65.15 etc are invalid

(2) Sample temperature T in deg C

T can be between 0 and 40

T can only have 0 or 0.5 after decimal point

Enter sample temperature T in deg C= **30.5**

Enter sample hydrometer reading HT = **99.9**

Input: T deg C= 30.5 , Hydrometer reading **99.90**

Output: Corresponding Degrees at 15 deg C from Table 1: **95.48**

Iflag=1

Density (gm/cc) of sample at 30.5 deg C = **0.79414** (Table -II)

Percentage w/w ethanol in sample= **95.42**

Percent v/v ethanol in sample at 15.56 degc (51 deg F)= **97.06**

London Proof (100 => 57.06 percent v/v @ 51 deg F) = **170.10**

Over Proof (100 => 57.06 percent v/v @ 51 deg F) = 70.10

Annexure – IIIB

Sample output: Strength conversion program – IS 2302 – 1989 to LP

Program for IS2302-1989 Table 1 developed by IIT Kgp

Inputs

(1) Hydrometer reading HT at sample temperature (T deg C)

HT can be between 72 and 102

HT must be a multiple of 0.1; 89.97, 65.15 etc are invalid

(2) Sample temperature T in deg C

T can be between 0 and 40

T can only have 0 or 0.5 after decimal point

Enter sample temperature T in deg C= **30.5**

Enter sample hydrometer reading HT = **99.9**

Input: T deg C= 30.5 , Hydrometer reading **99.9**

Output: Hydrometer reading at 20 deg C from Table 1 look up: **97.0**

Iflag=1

Litres at sample temperature per 100 kg = **126.8000** (Table -I last line)

Percentage w/w ethanol in sample= **97.07**

Percent v/v ethanol in sample at 15.56 degc (51 deg F)= **98.16**

London Proof (100 => 57.06 percent v/v @ 51 deg F) = **172.03**

Over Proof (100 => 57.06 percent v/v @ 51 deg F) = 72.03