GOVERNMENT OF ASSAM
OFFICE OF THE COMMISSIONER OF EXCISE :ASSAM :GUWAHATI ::

No. III-271/2017-18/129 Dt. Guwahati, the 26th Oct/2021

ORDER

In pursuance of Rule 96A of the Assam Excise Rules, 2016 as notified vide Notification No.Ex.176/2016/PT/140 dt. 29/9/2021, the Standard Operating procedure (SOP), containing details of technical specifications and guidelines related to installation and use of Mass Flow Meters, Radar Based Level Transmitters, Sensor based electronic bottle counters, PLC (Programmable Logic Controller) and other appliances/accessories , and the specified parameters required to be measured, recorded and archived through these devices, is hereby notified and enclosed herewith for compliance by all Manufactories and Distilleries, with immediate effect.

Sd/-

Commissioner of Excise, Assam
Housefed Complex, Dispur, Ghy -6.

Memo No. III-271/2017-18/129 -A Dt. Guwahati, the 26th Oct/2021

Copy to :-

1. The Principal Secretary to the Govt. of Assam, Excise Deptt, Dispur, Ghy -6 for favour of information.
2. The Superintendent of Excise, (all)..... for information and necessary action.
3. The Officer-in-charge, Manufactories/Distilleries (all)..... ..... for information and necessary action.
4. The licencee of Manufactories/Distilleries (all)..... ....for information and necessary action.

Commissioner of Excise, Assam
Housefed Complex, Dispur, Ghy -6.

STANDARD OPERATING PROCEDURE

FOR

INSTALLATION AND USE OF ELECTRONIC DEVICES SUCH AS MASS FLOW METERS, LEVEL TRANSMITTERS AND SENSOR BASED BOTTLE COUNTERS TO AUTOMATE THE PROCESS OF MEASUREMENT OF SPIRIT AND CONTROL MECHANISM IN POTABLE LIQUOR MANUFACTORIES AND DISTILLERIES

COMMISSIONERATE OF EXCISE

ASSAM

In pursuance of Rule 96A (4) of the Assam Excise Rules, 2016 as notified vide Notification No. Ex.176/2016/PT/140 dated 29.09.2021, the following Standard Operating Procedure, containing details of technical specifications and guidelines related to installation and use of Mass Flow Meters, Radar Based Level Transmitters, sensor based electronic bottle counters, PLC (Programmable Logic Controller) and other appliances/accessories, and the specified parameters required to be measured, recorded and archived through these devices, is notified for information and compliance by all manufactories and distilleries:

1. **Electronic and communication devices to be installed for proposed instrumentation and automation are following:-**

   a. **Mass Flow Meter** - A mass flow meter, is a device that measures mass flow rate of a fluid travelling through an oscillating tube. The mass flow rate is the mass of the fluid travelling a fixed point per unit time. Volumetric flow rate is calculated here as the mass flow rate divided by the fluid density. The device accurately measures the density of the liquid in respect of real time temperature. The density of the fluid may change with temperature, pressure, or composition of the fluid. The Mass Flow Meter installed in the manufactory shall have **Indian Metrology approval for custody transfer application.**

   b. **Radar Level Transmitter** - Radar Level Transmitter measures the distance from the transmitter/sensor located at the top of the tank to the surface of the spirit located further below, by sending radio waves out through open space to reflect off the liquid surface and measuring the time of flight of a travelling wave and then determine the level of the spirit in tank. It is a continuous level measurement device because it continues measurement, even as the level of the liquid in the vessel changes. Being mounted at the top of the tank, it measures the level of spirit in vats and

convert the level of spirit into volume though PLC (Programmable Logic Controller) by following the approved calibration chart of specified vat.

c. **PLC (Programmable Logic Controller)** - A Programmable Logic Controller (PLC) or programmable controller is an industrial digital computer which has been designed and adopted for the control of manufacturing process, such as assembly lines, or robotic devices, or any activity that requires higher reliability control and ease of programming and process fault diagnosis.

d. **HMI (Human Machine Interface)** - A Human Machine Interface (HMI) is the user interface that connects an operator to the controller for an industrial system. An HMI includes electronic components for signaling and controlling automation systems. The interface consists of hardware and software that allow user inputs to be translated as signals for machines that, in turn, provide the required result to the users. Human machine interfaces help in integrating humans into complex technological systems.

e. **Bottle Counter with ultrasonic/photoelectric sensor** - These devices are mounted after the filling unit and before packing of bottles in cartons in each bottling line. The counting devices operate accurately on sensor based technology to count the filled bottle produced in the bottling line. In the manufactory for every bottling line, whether it may be automatic or semi-automatic, there will be two bottle counters mounted on the conveyor belt. The first one shall be just after the filling unit. It will be laser guided reflector type sensor which will count the total quantity of bottle filled through the machine. On the same bottling line the second bottle counter shall be mounted from the top just after the hologram applicator to count the quantity of finished bottle produced. This second counter shall have dura beam laser sensor at a very narrow angle

radiation to count the number of bottle produced in the bottling line even at higher speed. The counters shall be configured with IO-linked interface to transmit the data to programmable logic controller of the manufactory. In the batch production report data from the second bottle counter shall be fed directly. Manual entry of quantity of bottle produced is thus overridden by the entry of sensor based bottle counter.

f. **Flame proof pumps** - It is fire proof pump which protects the pump from catching fire.

g. **Filter** - It filters any impurities present in the spirit or liquor.

h. **Air separator-cum-eliminator** - It is installed before the mass flow meter. The purpose of such installation is for neutralizing the errors that might occur due to differential air pressure and turbulence of the flow.

2. Software to be used for supervision:

a. **Supervisory Control and Data Acquisition (SCADA)** is a system of software and hardware elements that allows industrial organizations to Control industrial processes locally or at remote locations. The basic SCADA architecture begins with programmable logic controllers (PLCs) or remote terminal units (RTUs) PLCs and RTUs are microcomputers that communicate an array of objects such as factory machines, HMIs, sensors and end devices, and the route the information from those objects to computers with SCADA software. The SCADA software processes, distributes, and displays the data, helping operators and other employees analyze the data and make important decisions.

b. **Katmar Software** - The version ALCODENS LQ 3.3 of this Software provides a Density-concentration conversion Table of aqueous Ethanol mixture at any temperature Range. It provides data on conversions between density and concentration for ethanol - water mixtures at various units at any specific temperature. Data provided in this software

is compatible with the OIML standard. The transit wastage calculation method using Katmar Software is specified in as Annexure 1.

c. Unit of measurement of concentration of alcohol in spirit shall be % volume/volume.

Apart from real time trend historical data archiving will also be done in automation system. Technical details for the electronic devices mentioned above should be according to specification mentioned in as Annexure - 2.

To summarize, the proposed instrumentation will be able to display continuous data for the following measurements/parameters in the HMIs (operator's stations) of automation system. Besides real time trend, historical data archiving will also be done in automation system upto 6 months.

i. Rate of flow of OPS from the tanker to SSVs (spirit storage vats),

ii. Quantity in Mass and volume of OPS (over proof spirit) received from tanker,

iii. Temperature of OPS during unloading,

iv. Strength/Concentration of the OPS during unloading from the tanker to SSVs,

v. Annunciation & interlock of low and high-level alarms of OPS in air eliminator,

vi. Level measurement of OPS in each SSV,

vii. Volume (calculated & approximate) of OPS in each SSV.

viii. Level measurement of spirit in each RSV (reduction spirit vat).

ix. Volume calculated of spirit in each RSV.

x. Amount (calculated & approximate) of OPS received in RSV and SSV.

xi. Strength/Concentration of spirit in each RSV is to be measured through standardized digital or analog alcoholmeter.

xii. Volume, density and Strength/Concentration of CS (country spirit)/FL (foreign liquor) transferred to bottling line.

xiii. Filled bottles of liquor will be counted at conveyor belt by ultrasonic/photoelectric bottle counter.

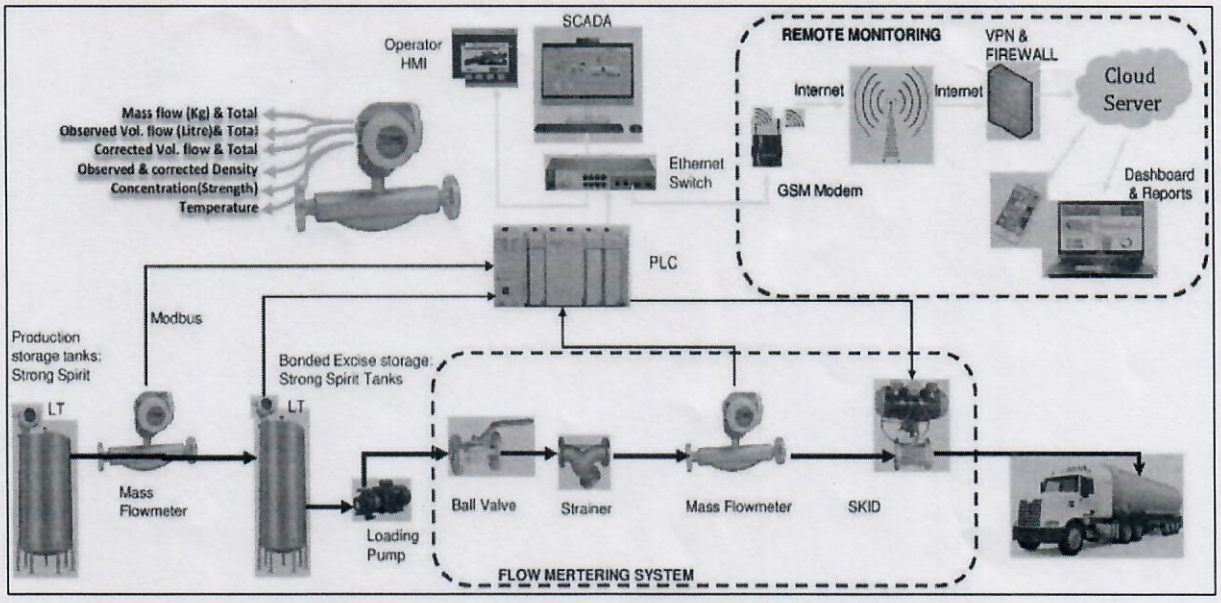
xiv. Reading from the sensor shall be simulated to the PLC control panel.

xv. Level Switch installed in the Overhead Tank to automate the Blended Spirit transfer from BV to OHT.

3. **Proposed instrumentation for liquor bottling units:** Integrated Automation System should be established as following schematic diagram, so as to avoid unaccounted production, unloading, bottling and dispatch in distilleries/breweries/bottling units of liquor :-

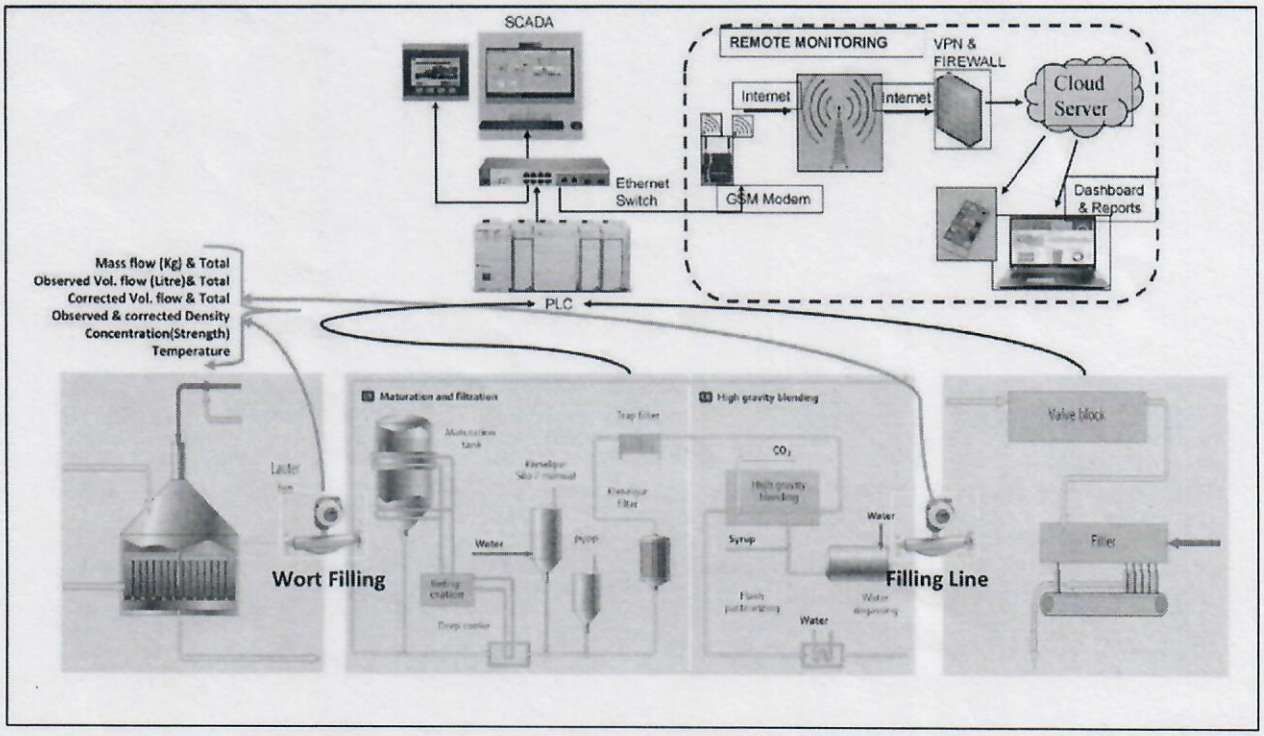
   a. ***At Distilleries*** -The "Mass Flow Meter" should be fitted before, Day Receiver Tank and Storage Vats. "Mass Flow Meter" should also be fitted at the loading points from where spirit is transferred from Storage Vat to tankers. Radar Level Transmitter should be fitted at the top of man whole cover of vats locked with digital locks.

   System Architecture for (Distillery Unit):



b. At Breweries: The "Mass Flow Meter" should be fitted before the "Bright Beer Tank" where beer is stored. It should also be fitted between "Bright Beer Tank" and "Service Tank" from which beer is released for bottling. Radar Level Transmitter should be fitted at the top of man whole cover of vats locked with digital locks.

System architecture should be as follows :-



c. At Bottling Units or manufactories:

Stage I - Receipt of Spirit - The Mass flow meter installed at the ingress of the manufactories with an arrangement of filter, air separator, and PLC Controlled actuated ball or solenoid valve shall measure the flow of strong spirit that has been procured through Import or transport. This arrangement will ensure the removal of unexpected solid particles and air bubbles from the process flow line. At this stage the strong spirits in the form of GENA, GRS and Malt Spirit shall be received through this device. This mass flow meter measures the mass per unit time (e.g., kilograms per second) density

and temperature of such strong spirit flowing through the device. Volumetric flow rate is the mass flow rate divided by the fluid density. From this Volume density, temperature and Strength/Concentration (using the Katmar Software) will be recorded continuously in the PLC system during the currency of the flow, and after completion of unloading the average Volume and Strength/Concentration are recorded for further accounting.

Stage - II Processing - There is no intervention in process of reduction and blending of spirit as discussed above. The process flow in country spirit and foreign liquor will be continued and at this stage of instrumentation only the final concentration at % V/V as well as Density at gm/CC at certain temperature of Spirit and Blended Spirit will be taken care of. The devices involved at this stage have to be calibrated from competent authority.

In all the storage vats, reduction tanks and blending vats the installed Radar based Level Transmitter shall record the Level dip of spirit in tanks as well as the PLC attached to the level transmitter shall display the volume in Bulk litre in accordance with the updated 'dip-volume' table certified by the Department of Legal Metrology. This automation shall eliminate the manual intervention in gauging and proving of the spirit stored in tanks.

Different CS Manufactories uses water from various sources like bore well water or soft water or demineralised water or raw water. The water containing salts and dissolved sonlids at higher proportion added in OPS in RSVs, results in 'obscuration'. Obscuration is defined in BIS 6749 as, "The difference caused by matter in solution (or suspension in a colloidal state) between the Strength/Concentration of spirit and the apparent Strength/Concentration as indicated by the hydrometer or other instrument for recording alcoholic Strength/Concentration."

Mass flow meter cannot differentiate the density interference caused by the higher concentration of dissolved solids and minerals added with alcohol and so in the automation system use of demineralised water in manufacturing of potable liquor is mandatory to avert the possibility of nothing wrong density and thereby the Strength/Concentration of spirit.

Stage - III- Bottling - The mass flow meter installed at the ingress of the blending tank or reduction tank to transfer the fluid to the service tank or day tank shall also be equipped with the same arrangement of filter, air separator, solenoid valve/actuated ball valve followed by the Mass Flow Meter and shall record the transfer of Blended spirit for bottling. Pump and actuated valve operation through PLC shall avoid unexpected back flow in the line through flow meter. The same is achieved by putting a non-return valve in the line.

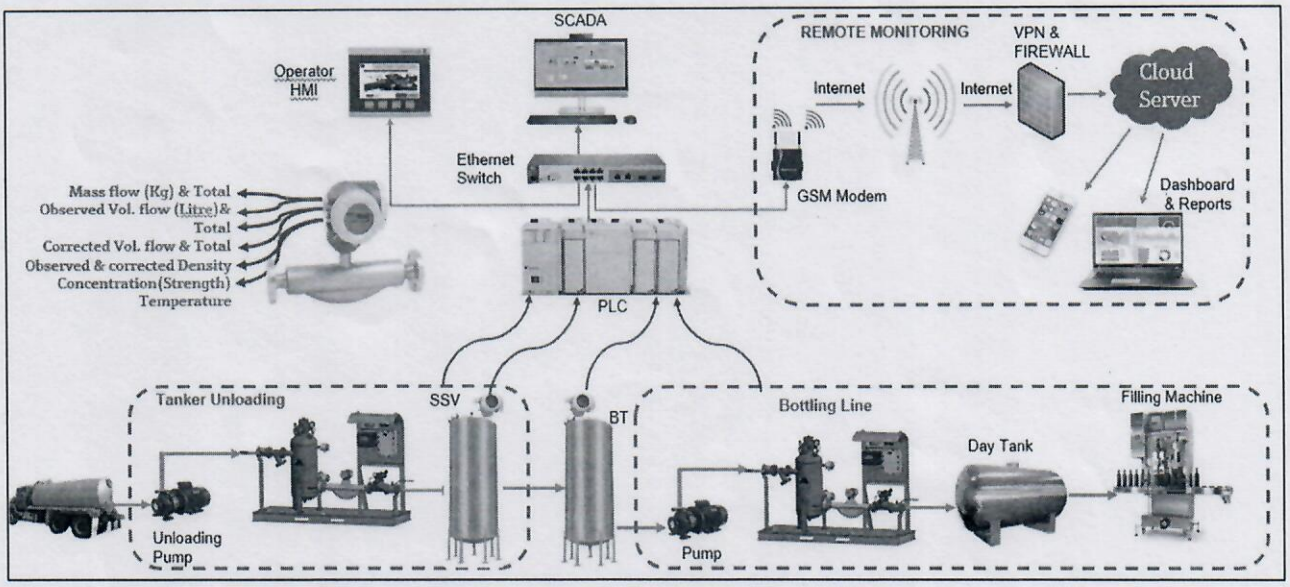
The instrumentation proposed, shall not only minimize the manual intervention in production processes in the manufactories but also provide a very effective control from the Excise point of view. Actually the Mass flow meter installed at the ingress of spirit in the manufactories gives density and/or concentration stipulated in BIS standard for becoming any spirit to be ENA shall be incorporated in the program logic of the Mass Flow Meter in such a manner that any spirit having concentration lower than that, would never be passed through this flow meter. The gateway will open only at the desired range of density and/or concentration.

In case of final blended spirit with the desired density and/or concentration sent for bottling, has to pass through a flow meter. The PLC has been programmed in such fashion that any deviation from this desired range of concentration/strength the passage of the said spirit will be blocked

and shall put a call for rectification. This allowable range of strength/concentration is denoted as Threshold Range.

Two ultrasonic/laser based bottle counter shall be installed and mounted on the conveyor belt of each bottle filling line. These will be positioned just after filler unit and after the application machine used for affixation of hologram to count the finished bottle produced through the filler.

System architecture should be as follows:-



4. **Installation points of Mass Flow Meter at the Liquor Manufactories:**
   a. At the point of receipt of Strong spirit from the tanker on the common intake pipe line after the pump unit the first Mall Flow Meter shall be installed (MFM- I). Where there is a common intake pipe line for all SST vats one flow meter can control the receipt of strong spirit in different SST vats. But if the SST vats are separately linked with the pumps and there is no common intake valve then the unit needs separate installation of Mass Flow Meter for each SST vats. The units of Pump, Filter, Air Separator cum air eliminator, Control valve and Mass Flow Meter shall be in integrated fixed pipe line. **No Flexible pipe line shall be allowed between pump to flow meter.** To neutralize the effect of

vibration of pump a flexible arrangement can be placed between air eliminator and flow meter only. **There shall be no bi-pass pipe line in ingress avoiding the Mass Flow Meter.**

b. The second phase installation of Mass Flow Meter shall be introduced in between the Blend Holding Tank/Blending Tank/ Reduction Tank and the service tank/day tank of the bottling line (M.F.M.- II). For each separate service/day tank a separate flow meter needs to be introduced. But where there is no service tank before the bottling line, every line shall be attached to a flow meter. This will measure the quantity of blended spirit issued for bottling. The total quantity of bottling wastage for a quantity of issued blend can be measured at this stage.

c. To ascertain the level of spirit in the storage tanks, reduction and blending tanks, Radar based Level Transmitters are to be installed at the top head of the storage and blending tanks. These will give the accurate reading the height of the spirit in the storage and blending tanks. The accuracy level of the device should not be less than 2 mm. To measure the height of the spirit column accurately the Level Transmitters are to installed with the fixed part of roof of the tanks so that it can nullify the effect of vibration as well as operation through the lid of the tanks. **4/20 mA signal from Rader Based Level Transmitter should pass through "Zenar Barrier" to PLC so that incident of fire hazard is avoided.**

d. The PLC of all these measuring devices are to be preserved in a separate control room close to the manufacturing unit in an environment of controlled temperature and with a back-up power supply for 24 hours.

e. The HMI or control panel shall be installed in the process area so that command on pump operation may not be delayed much.

f. The pump in the production units shall be in remote/auto mode so that the operation can be controlled by the PLC as well as from local operator

switch. **The Mass Flow Meter shall be designed with the maximum flow rate of the pump.**

5. Mandatory guidelines during installation of Flow Meter:

The operation of Mass Flow Meter and Radar based Level Transmitter depends on the point of installation and the environment offered in the production unit. Depending on the function of pump, orientation of pipelines, viscosity of the fluid to be passed and intervention of air dissolved in the fluid the following guidelines are to be strictly observed for seamless operation in the plants :

a. An air eliminator cum air separator shall be installed before the Flow Meter-I and Flow Meter- II. The purpose of such installation is for neutralizing the errors that might occur due to different air pressure and turbulence of the flow. The mass flow shall be intransically safe and explosion free.

b. The M.F.M- I and M.F.M.- II shall be installed on the linear section of the pipe line through which spirit shall be received or issued to other spirit tanks.

c. The flow meters and Level Transmitters installed shall strictly conform to the specifications framed in this regard including the hazardous areas safety regulations framed by the competent authority.

d. During the course of bottling total amount of rejected bottle spirit at the bottling line, if any, shall be stored in a small S.S. tank adjacent to the bottling line. This tank will be equipped with a built in filtering unit. The rejected bottle spirit here after filtration shall be again transferred to the holding/ service tank for further bottling through a separate pump and pipe line arrangement.

e. To avoid the double accounting through flow meter, the rejected bottled spirit shall not be transferred to the blending tank in process flow. Such amount of spirit in the rejection tank shall be bottled through the same service tank from where it was issued.

f. The meter should be installed so that it will remain full of liquid and so air cannot get trapped inside the tubes. The most desirable installation is in vertical upward flow pipes, but installations in horizontal lines are also acceptable. It is recommended to install (upstream of the meter) strainer, filters or air/vapour eliminators as required to remove all undesirable secondary phases.

g. "Sizing Sheet" of Mass Flow Meter shall be submitted to the nodal Excise Officer before installation for proper verification of accuracy.

h. The accuracy of Mass Flow Meter shall not be lower than 0.1% at minimum flow rate and maximum flow rate.

The electronic devices used in the manufactory in all field level including cable shall have specifications of explosion protection.

i. System design characteristics are the features that can result in minimizing the presence of air design stage include: -

- Common piping used for pumping into and out of storage tanks,
- Allowing the formation of a vortex in stirred vessels under low-level conditions,
- Allowing air leakage through packing glands of pumps that develop high vacuums on the suction side (this can occur when pumping from underground storage).
- Vaporization of stagnant process fluid in pipes exposed to the sun,
- High valve pressure drops causing vaporization and flashing,

- Allowing the pipe to drain for any reason, including lack of check valves,
- Allowing storage tanks, trucks, or railroad cars to drain completely,
- Using the same pipe for pumping different materials st different times,
- Allowing foam formation by high turbulence in high velocity fluids.

6. **Mandatory guidelines to be followed by all distilleries/breweries and bottling units:**

   a. All distilleries/ breweries and bottling units established and working in Assam should install a "Twin Tube Coriolis Mass Flow Meter" according to the specification of Indian Meteorological Department.

   b. The accuracy level of data of "Mass Flow Meter" should not be less than ±0.1% at the maximum and minimum flow rate of liquid passing through it.

   c. For consistency in the data of "Mass Flow Meter" to be installed in distilleries/ breweries and bottling units, it should be according to the specification of Organization International Legal Metrology (OIML).

   d. The "Mass Flow Meter" should be fitted with a Temperature Sensor having accuracy level of ± 0.1%.

   e. An Air Eliminator/Air Separator should be fitted before the "Mass Flow Meter", so that the exact volume/mass/ density flowing through it can be measured without any discrepancies.

   f. No flexible pipe should be used between the pump and "Mass Flow Meter". No bypass pipeline is allowed to avoid the "Mass Flow Meter". The pump used for transfer of spirit/liquor should be placed before the "Mass Flow Meter". The pump connected with the "Mass Flow Meter" should be fire proof.

g. The pump to be used in a production unit should be enabled in Remote/Auto Mode, so that operations can be controlled from the PLC. The "Mass Flow Meter" should be designed according to the maximum flow rate of the pump.

h. For knowing the exact quantity of liquor/beer produced in bottles a Bottle Counter with Ultra Sonic/Photo Electric Sensor shall be installed in every bottling line.

i. All Storage VATS, Compounding/Blending VATS and Reduction VATS should be fitted with ***"Radar Based Level Transmitter"*** at the top of manhole cover it to know the exact quantity of liquid stored in it. The accuracy level of Radar Based Level Transmitter should be within the range of ± 2mm. The signal of 4-20/mA from Radar Based Level Transmitter to PLC should be sent through Zenor Barrier to avoid any kind of fire hazard.

j. The reading from the Radar Based Level Transmitter should be taken at least 45 minutes after the transfer/storage of liquid in the VAT.

k. The "Mass Flow Meter" should be connected with a Programmable Logic Controller (PLC) and Human Machine Interface (HMI) for knowing the accurate data about volume, Strength/Concentration and density of spirit/beer/liquor stored and also the loss occurred. PLC should be established in a separate air conditioned room having uninterrupted power supply (24 x 7), so that no data is lost due to power failure.

l. The "Mass Flow Meter" and "Radar Based Level Transmitter" should be connected with SCADA (Supervisory Control and Data Acquisition) Software.

7. Batch preparation and batch production in new automated system:

The preparation of a particular batch of any registered brand in manufactory shall be guided by operation of newly installed electronic devices as follows :

a. In those cases, where a single batch is prepared and produced through a single RSV or BT or BHT, the VAT number is to be selected from the drop down box of the HMI or control panel of MFM.
b. This newly introduced automated system enables the manufactory to opt with multiple vats also in one particular batch of any brand. One single batch may be prepared through multiple RSV or BT too. i.e. by way of clubbing of vats as one batch.
c. In that case multiple vats are to be selected from the drop down box of the HMI or control panel of MFM. Moreover, total Batch volume has to be declared in the logic control of MFM as 'Total volume' incurred upon the total blend prepared in all the RSVs or BTs included in that batch. This has to be entered in control panel for MFM before production.
d. At the initial stage of automation for initiation of such clubbing of VATs the licensee company of the manufactory shall get the permission of the excise officer in charge of the manufactory. But if such vat clubbing is to be done in the later stage, permission from Nodal Officer of Excise Directorate shall be mandatory.
e. One batch has to be produced through one single Mass Flow Meter.
f. One particular batch shall be produced in a day's production. The batch no. created shall contain the characters like 100-1. It will be produced on the first day of bottling.
g. During bottling if the total blend of a particular batch prepared, has not been completed in a day it will be carried forward in the next day with

a new batch e.g. 100-2 and so on for continuation of the production in multiple days.

h. When a blend of a particular base no. (e.g. 100) is bottled in multiple days, system PLC will generate separate production report for every single batch bottled in separate days.

i. In case of vat clubbing for a single batch when total volume has been bottled from all the vats then the Excise Officer in charge of the plant shall press the 'Batch End' option in the control panel. There after the system shall not allow any further production of the same batch through the MFM.

j. When the batch length has been clubbed with multiple Vats then in respect of every RSV or BT or BHT the processing shall be similar as present. The different vats of a single batch are to be prepared in an identical manner so that the density, alcoholic Strength/Concentration, clarity factor, colour % (absorbance), pH, conductivity remain identical, though the density and Strength/Concentration of the blends in different vats may have minute variation. After production of the entire batch the MFM will consider the average value of density, Strength/Concentration and temperature as batch value. After preparation of batch, compaised of multiple vats, chemical samples have to be drawn from each vat for analysis.

k. After completion of such Batch as the Batch End option has been activated in the Control Panel of MFM similarly the Batch End Process has to be entered.

l. Bottling, wastage (production wastage) shall be calculated against each batch.

m. The data from sensor based bottle counters for count of production shall be recorded in PLC control page and from these data the batch report and production report will be generated.

8. Integration of Data received from Mass Flow Meter and Radar Level Transmitter:

a. In Unloading - The MFM- I shall give the final output about the quantity of strong spirit received with the added parameters of density, temperature and concentration in %v/v. After giving the temperature end the final volume will be derived. The difference between the Flow Meter reading and Level Transmitter reading of Volume in A.L. if any, shall be compensated as operational wastage or operational increase in SPIRIT STORAGE REGISTER.

b. In bottling - The MFM- II shall give the final output about the blended spirit passed to holding/service tank for bottling. The difference in F.M.- II reading and reading of Level transmitter volume in A.L shall be recorded as operational wastage or operational increase in SPIRIT STORAGE REGISTER.

c. For all kind of receipt and transfer of spirits in different storage tanks the reading of the Radar based Level Transmitter shall be compared. Difference in volume, if any, thus registered, shall be recorded as 'operational wastage' or 'operational increase' for the operation.

d. The Level Transmitter shall record a dip in the beginning of the days' operation by default and generate an opening report for each tank and similarly at the end of the day's operation another dip will be recorded as final dip and a closing volume for each tank will be reported.

e. For each and every operation in storage tanks, Level Transmitter dip shall be recorded after settling of the upper level of the fluid. It will be safe to record the dip after 45 min. of completion of every operation.

9. **Strength/Concentration control in Programmable Logic Controller (PLC) as per OIML:**

a. Strength/Concentration of the ENA and bottled spirit is a function of temperature& density.

b. These Strength/Concentration measured by flowmeter directly will be monitored by the PLC at all temperature.

c. The PLC will compare the real time Strength/Concentration measured by flowmeter of the spirit at a certain temperature with the pre-determined data already incorporated within it.

d. A threshold Strength/Concentration range for process fluid is PLC is fixed, beyond which range the flow will be cut off by the solenoid valve/actuated ball valve. For unloading of strong spirit the threshold Strength/Concentration range has been set in PLC as per the guideline derived by Excise Authority within temperature of 0^0C to 50^0C. For bottling in MFM- II, the threshold Strength/Concentration range has been set in PLC as per the guideline derived by Excise Authority within the temperature of 0^0C to 50^0C.

e. All the control of the digital electronic devices are vested to the Excise Officer-in- charge of the Manufactory. The entry in the digital control panel is totally password protected and in case of any trip of the control valve due to deviation of concentration of the liquid from the prescribed one, the Control Panel shall seek the intervention of the Excise Officer-in-charge of the manufactory for further operation. In case of repeated error concentration, to continue with the production

the excise officer-in-charge of the Manufactory shall have to seek approval from Excise commissioner in this regard.

10. **Installation and operation of Bottle counters:** In the manufactory for every bottling line, whether it may be automatic or semi-automatic, there will be two bottle counters mounted on the conveyor belt. The first one shall be just after the filling unit. It will be laser guided reflector type sensor which will count the total quantity of bottle filled through the machine. On the same bottling line the second bottle counter shall be mounted from the top just after the hologram applicator to count the quantity of finished bottle produced. This second counter shall have dura beam laser sensor at a very narrow angle radiation to count the number of bottle produced in the bottling line even at higher speed. The counters shall be configured with IO-linked interface to transmit the data to programmable logic controller of the manufactory. In the batch production report data from the second bottle counter shall be fed directly. Manual entry of quantity of bottle produced is thus overridden by the entry of sensor based bottle counter.

    Few quantities of filled bottles are sorted out by quality check in the bottling line. These are recycled again through the overhead tank. So there will be a difference between the report of first bottle counter and second bottle counter. The difference in AL thus measured is the quantity of spirit recycled in a batch.

11. **Recording of data and generation of reports:** At all the operations during offloading strong spirits in storage vats and during transfer of the blended spirit to the service tank/day tank/holding tank for bottling, in this automated system, the total operation shall be recorded digitally in continuation with the process at an interval of 5 sec. in PLC through a software named SCADA.

SCADA is an acronym for **"supervisory control and data acquisition"**, a computer system for gathering and analyzing real time data. SCADA systems are used to monitor and control a plant or equipment in industries. SCADA is taking signal from PLC and display on PC or HMI based on animation. So basically SCADA is one type of software which gives real time monitoring for the process or wok with animation.

These accumulated data for a particular operation in the manufactory shall be compiled to generate a report of the same in the system. Depending on the operations reports may be classified as follows :-

a. Report for unloading of strong spirit,

b. Report for a batch production,

c. Report for a day's production through a MFM,

d. Level Transmitter report of opening and closing balance of spirit in vats,

e. Bottle production report based on bottling line, etc.

For keeping of records in the manufactory several utility register forms shall have to be maintained in the unit. These registers shall reflect the whole process of storage, receipt transfer, reduction, blending, maturing and bottling of spirit either digitally or through book keeping. Records of Mass Flow Meter operation shall be maintained separately in digital form. The replica of the data archived digital form. The replica of the data archived and report generated shall be fetched to the central control room of the Excise Headquarter for further data mining and analysis thereafter.

Registers to be maintain in manufactory to work with automated system are as follows :-

i. Spirit entry register,

ii. Spirit storage register,

iii. Batch production register,

iv. Spirit accounting register,

v. Finished bottle storage register,

vi. P.L. account registers for excise duty and additional fees for unloading & bottling.

The Excise Officer in charge of the manufactory shall maintain the updates in the register forms on daily basis. The summary transaction made at the end of the month for every register shall be counter signed by the authorized representation of the licensee company. The licensed manufactory shall also ensure that detailed report of manufactory is submitted to Excise Headquarter every month.

12. **Central control system: Remote Monitoring:** The architecture and functionality of proposed remote monitoring system foreign liquor manufactories are as follows :-

a. Online view of the SCADA screen at the central control room to monitor day to day operation of each of the plant.

b. Viewing of the generated reports for each plant from the central location.

c. Building of repository of historical performance data from the daily report to form a concentrated data base for all the plants in a single location.

d. Capability of data analytics on the huge pool of performance and key data for creating dash boards and analytical reports at **C-level on defined KPI Matrix.**

Procedure for collection of data :- The online data from each manufactory location will be loaded on real time basis in OPC format through VPN concentration over internet provided at SLDC. The central OPC server will collect data from all plants and central SCADA software will be used to view the online graphics. Dedicated server space will be provided along with secured data connectivity at SLDC (State Level Data Center) for loading the software and data will be viewed from central control room at Excise Headquarter through VAM. Reports from each of the manufactories will be uploaded to the central server and stored in respective folders automatically at predefined time for each plant.

Annexure 1:

Unloading of strong spirit and calculation of transit wastages Using KATMAR Software:

a) Strong spirit is received in the Bottling Plants or Manufactories in two ways:

i. By Importing from other States of India

ii. By Transporting from Distilleries within Assam.

In both the cases Strong spirits in the form of Grain ENA, Grain R.S., Malt Spirit etc. shall be received through Mass Flow Meter (M.F.M.- I).

b) The Mass Flow Meter shall record the data for unloading of spirit in a progressive manner at 5 second interval on following distinct parameters :

i. Transferred mass (in Kg.)

ii. Real time density (in gm/CC or kg/m^3)

iii. Real time temperature (in Deg-C)

iv. Real time concentration (in %v/v) (Inbuilt)

v. Transferred volume (in bulk litre)

c) From these progressive data of the total unloading process finally a Unloading Report will be generated with the following distinct parameters:

i. Total transferred mass (in Kg)

ii. Average density (in gm/CC or kg/m^3)

iii. Average temperature (in Deg-C)

iv. Average concentration (in %v/v) - At 20^0C referral temperature.

v. Total transferred volume (in bulk litre)

On completion of the unloading of strong spirit the report received from the system shall be compared to the advice endorsed in the Transport Pass or Export Pass as the case may be. As density and temperature of the process fluid transferred through the Flow Meter are the primary data to calculate Volume of spirit received,

the advised and receipt volume of spirit are to be compared keeping both the density at the same temperature.

Comparison of Excisable Alcohol in case of Transported consignment:

At the consignor end, various parameters are recorded through Mass Flow Meter. Therefore, at the consignee end the density, temperature, mass of the spirit, volume of the spirit, strength in %v/v and thereby excisable alcohol can be compared with the data recorded at the consignor end.

The temperature and density of spirit are most important to calculate the excisable alcohol. Liquid expands when heated and contracts when cooled, so their respective densities are increased by cold and lessened by heat. In order to compare the volume of spirit loaded at the transporting/importing end with the volume at receiving end the temperature factor must be taken care of.

A density correction and subsequently a volume correction need to be incorporated on the data received through Unloading Report. The quantity of spirit received at the consignee end (Manufactory) shall be compared with the advised quantity of spirit @ temperature of the receiving end. The advised excisable alcohol (A.L.) calculated @ temperature of the receiving end shall be compared with the received excisable alcohol (A.L.), i.e. @ average temperature recorded by the Mass Flow Meter at manufactory. To ensure this conversion, OIML certified density conversion table e.g. Alcodens LQ 3.3 (Katmar software) may be consulted. If the average temperature of spirit at the consignor end (Distillery) is recorded as T_{1^0} Cand that at consignee end (Manufactory) be T_{2^0}C, then the volume advised at the consignee end has to be calculated at @ Temperature T_{2^0}C.

On such basis the excisable alcohol in advise shall be derived by this formula:-

Excisable Alcohol (In AL) = Vol. of Spirit at $T_2{}^0C$ x $\frac{\text{Strength of Alcohol in \%v/v}}{100}$

Thereafter excisable alcohol in advice and in receipt shall be compared to calculate the transit increase or wastage.

Example 1 :- Showing conversion of volume for transported consignment:

In advice :

Temperature recorded in T.P. (T_1)

Mass issued (M_1)

Total volume issued (V_1)

Strength in advice (S_1)

Density calculated through Alcodens conversion table at T1 = (D_1)

Density converted at temperature $T_2{}^0C$ = (D)

Advised volume at temperature $T_2{}^0C$ = (V)

Excisable alcohol in advise at $T_2{}^0C$ = V x $S_1/100$.

In receipt :

Temperature recorded by MFM-I = (T_2)

Mass transferred = (M_2) (in Kg.)

Total volume transferred = (V_2)

Density at current temperature = (D_2)

Excisable alcohol received at Manufactory = $V_2 \times S_2/100$

Transit wastage = ($V \times S_1/100 - V_2 \times S_2/100$)

Comparison of excisable alcohol in case of imported consignment:

At the consignor end the uploading of spirit in the tanker is not measured by the Mass Flow Meter.

The Export Pass only records the following parameters:

When the consignment is imported from other States of India the actual mass of the strong spirit is not mentioned in the export order/pass. Rather the following data are mentioned for reference at the consignor end -

i. Volume in bulk litre (V_1),

ii. Concentration/Strength either in %v/v or in Deg-Proof (OP) (S_1)

iii. Temperature (T_1)

In case of importing consignment from the data of temperature in ^{0}C and strength at %v/v in Export Pass, the density (D_1) has to be derived in gm/cc. Through this density the mass of spirit in advise (M_1) shall be calculated using Mass = Volume in BL x density. Thereafter the procedure is same as the transported consignment.

If the average temperature of spirit at the consignee end (Manufactory) is recorded as $T_2{}^0$C then the volume advised at the consignor end (Distillery) has to be derived at @ Temperature $T_2{}^0$C. In the Density conversion table of Alcodens LQ 3.3 (Katmar software) the unit of temperature has to be same.

Thereafter the excisable alcohol in advise shall be derived by the formula,

$$\text{Excisable Alcohol (in AL)} = \text{Vol. of Spirit at } T_2{}^0\text{C} \times \frac{\text{Strength of Alcohol at \%v/v}}{100}$$

At the consignee end (Manufactory) the Mass Flow Meter shall record the value of receipt of spirit in the same manner as depicted earlier and similarly the Excisable alcohol shall be calculated as follows :-

$$\text{Excisable Alcohol (in AL)} = \text{Vol. of Spirit at } T_2{}^0\text{C} \times \frac{\text{Strength of Alcohol at \%v/v}}{100}$$

Thereafter excisable alcohol of advise and receipt shall be compared to calculate the transit increase or wastage.

Example 2 : Showing conversion of volume for imported consignment :

In advise:

Temperature recorded in E.P. =		(T_1)
Volume in advise	=	(V_1)
Density	=	(D_1) (derived)
Mass in advise	=	(M_1) or (derived)
Strength	=	(S_1)

The density (D_1) of spirit in advise is derived through alcodens conversion table considering it's strength (S_1). Subsequently the mass in advise (M_1) is derived by multiplying volume in advise (V_1) with it's density (D_1).

According to the Mass Flow Meter report at receiving Manufactory:

In receipt:

Density	=	(D_2)
Average Temperature	=	(T_2)
Mass received	=	(M_2)
Volume received	=	(V_1)
Strength	=	(S_2)

The volume in advise shall be calculated at the temperature of the manufactory using alcodens LQ 3.3 (Katmar software),

The density (D_1) is converted @ the temperature T_2, is D

$$\text{Corrected volume} = \frac{\text{Mass in advise } (M_1)}{\text{Corrected density (D)}} = V_{\text{corrected}}$$

Excisable alcohol in Advise at current temp. of Manufactory = V_3

Excisable alcohol in receipt = $V_2 \times S_2/100$

transit wastage = ($V_3 - V_2 \times S_2/100$)

Note-To work with Alcodens LQ 3.3 (Katmar software) all parameters i.e. density etc. are decided & converted using standard Katmar software

ANNEXURE-2

AIR ELIMINATOR		
Make	:	As per approved vendor list
Model No.	:	Vendor to specify
Mounting	:	In line at upstream of the Flow Meter
End connection	:	Flanged
Seal/o ring	:	VTS
Body/flange material	:	SS 304 (desired)
Flow rate	:	500 LPM (nominal) or more
Pressure	:	2-12 kg/cm2
Drain/vent	:	Required (fitted with SS needle valves)
DIGITAL CONTROL VALVE (Complete Fire Safe Design)		
Model	:	Vendor to specify
Type	:	Rack & pinion actuator, solenoid controlled two Stage or on/off. Pneumatic operated, Fire Safe Design
End connection	:	Flanged
Service	:	Alcohol
Flow rate	:	500 LPM (nominal) or more
Mounting	:	Upstream or Downstream of Flow Meter
Valve body	:	SS 304
All internal parts	:	SS
ISOLATION VALVE (MANUAL)		
Model	:	Vendor to specify
Type	:	Manual operated isolation valve
Type of valve body	:	Ball
Size	:	VTS
End connection	:	Flanged
Service	:	Alcohol
Flow rate	:	500 LPM (nominal) or more
Design pressure	:	15 kg/cm2 to 20 kg/cm2
Operating Pressure	:	2-12 kg/cm2
Mounting	:	Upstream or Downstream of Flow Meter
Valve body	:	SS 304

Ball/trim	:	SS 304
All internal parts	:	SS
MASS FLOW METER		
Make	:	As per approved vendor list
Area Classification	:	ATEX+IECEx; Z0/1, Z21, Ex d, IIC/IIIC
Size	:	Vendor to Specify
Service	:	Alcohol
Operating pressure	:	1-12 kg/cm^2
Operating temperature	:	Ambient
Operating density	:	700 kg/m^3 to 2000 kg/m^3
Allowable pressure drop	:	0.5 kg/cm^2 to 1.0 kg/cm^2
Type	:	Microprocessor based Coriolis Mass Flow and density transmitter (dual tube)
Transmitter	:	Integral to sensor
Sensor tube	:	SS316L/SS 904L
Wetted parts	:	SS316L/SS 904L
Flow direction	:	Bi-directional
Measured Parameter	:	Flow (mass/volume), density, temperature, Alcohol Concentration/Strength in % V/V (Inbuilt)
Transmitter body	:	Die cast Aluminum
Display	:	Minimum 4 Line Back Lit Display (Onsite Display with Temperature, Strength, Volume Flow Rate and Totalizer)
Mass/volume accuracy	:	+/- 0.1% of reading
Density	:	+/- 0.0005 g/c
Repeatability	:	+/- 0.05
Outputs/Inputs	:	1) Frequency 2) 4-20 ma. 3) 4-20 mA Input for External RTD and Temperature Transmitter
Communication interface	:	Modbus RS 485
Custody transfer	:	1) OIML R117 2) Indian Weights & Measures 3) It should also be NMI approved.
W & M lock	:	Yes (required)

Calibration	:	The Mass Flow Meter shall be factory calibrated for minimum 2 points, on Calibration rig which is accredited by the National/International metrology authority. Secondary method/Master Meter Method of Calibration are not acceptable. Manufacturers, who do not have In-house facility for Gravimetric Calibration, shall send their Meters to FCRI/ other certified lab for calibration. A copy of the ISO/IEC 17025 accreditation certificate of the calibration lab shall be submitted along with the bid. Proving & W & M stamping MFM shall be done at the site.
PROGRAMMABLE LOGIC CONTROLLER		
Make	:	Vendor to specify
Area Classification	:	Safe Area
Function	:	Loading/Unloading/Transfer Operation and Level Monitoring of Alcohol Distilleries & Bottling Plants.
IO Capability	:	Vendor to specify
Communication	:	Modbus Protocol (RS485/TCP/IP)
Enclosure	:	Vendor to specify
HMI	:	Separate LED Monitor with Software for Data Monitoring and Control Function.
RADAR LEVEL INSTRUMENTS		
Make	:	Vendor to specify
Area Classification	:	ATEX II 1/2G Ex ia IIC T6 Ga/Gb
Size	:	VTS
Output	:	2 Wire 4-20mA HART
Display	:	Display with Push Button Configuration
Housing	:	Plastic PBT or Equivalent VTS
Accuracy	:	Not more than +/- 2mm (Reference Accuracy)
Measuring Range	:	10 Meter or more
Pressure	:	-1 to 4 Bar
Temperature	:	-40 to 100 Deg-C

Features Required	:	• Continuous Self-Monitoring of device. • Diagnostic Messages on display/Asset Management Software • Device functionality to check on demand without interrupting the process.