



Kuster Company

Operating Instructions

Flow Through Sampler (FTS)

Transfer Apparatus

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TRANSFER APPARATUS

FLOW THROUGH SAMPLER

OPERATING INSTRUCTIONS

Description:

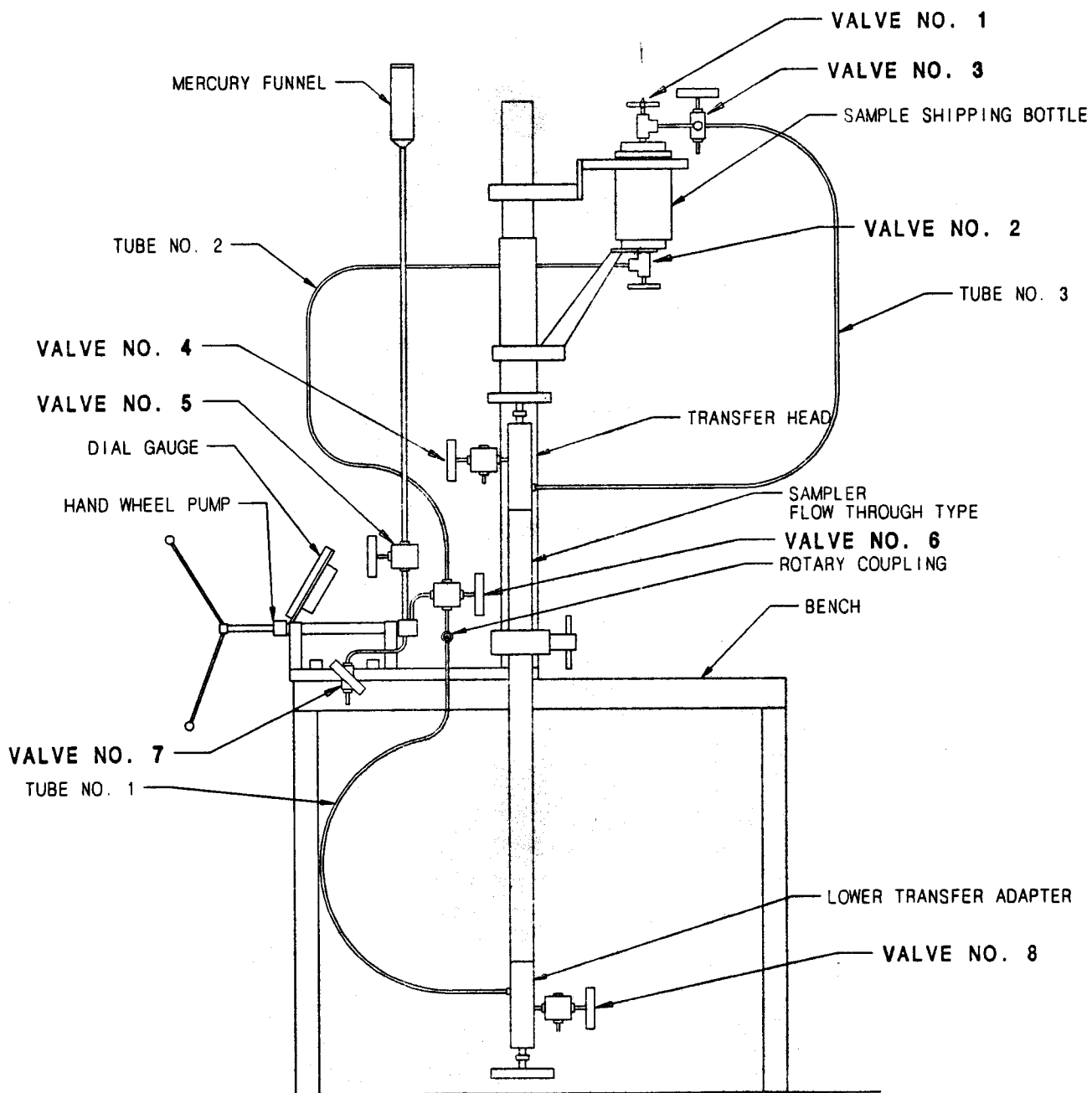
The KUSTER transfer apparatus allows displacement of the sample contained in the KUSTER flow through type sampler to a sample shipping bottle. The pressure on the sample is maintained at all times to prevent loss of solution gases. To accomplish this the sampler and sample bottle are installed on the transfer apparatus. The transfer apparatus provides a means of connecting the sampler and sample bottle with tubing. It also has a positive displacement hand wheel pump used to balance the pressure in the system. The actual transfer is made by filling the sample bottle with mercury and placing it in a position higher than the sampler. The system is then pressurized to a point equaling the pressure of the sample and the connecting valves are opened. The weight of the mercury forces it to flow into the sampler, displacing the sample into the sample bottle. After the sample is completely transferred the valves on the shipping bottle are closed and the shipping bottle can be removed from the apparatus.

Caution:

Mercury used in the transfer apparatus is extremely toxic. Please read the enclosed information. When handling, gloves and eye protection should always be worn. The transfer should be made in a well ventilated area and container should always be put under the transfer apparatus to catch any spills or leakage. It is also recommended that a large sheet of plastic be laid on the floor to catch anything that misses or splashes out of the catch container. This provides an easy way to clean up spilled mercury.

TRANSFER APPARATUS

FLOW THROUGH TYPE SAMPLER



PART DESCRIPTION				ASSEMBLY WHERE USED			
TRANSFER APPARATUS LAYOUT				KUSTER COMPANY 2900 E 29TH ST LONG BEACH, CA.			
FLOW THROUGH TYPE							
DRAWN	LMK	APPROVED	DATE	SHEET	REV	FILE NAME	11580AR2
DIMENSIONS PER ANSI Y14-5M				SCALE	NTS	1 OF 1	DWG NO. 11580-201

Mounting Transfer Apparatus:

The transfer apparatus is designed to be mounted on a bench that is at least 42 inches high. It should be bolted to the front, right hand corner of the bench through the 2 holes provided. The tube extension can be installed and the 2 sampler clamps can be removed.

Sampler Preparation:

1. Remove following items from sampler
 - Bull nose
 - Clock housing
 - CouplingThe valve stems and springs will be exposed on both ends of the sampler.
2. Clean the valves and install O-rings in groove provided in each end.
3. Install bleed valve assembly on transfer head if it is not already done.
4. Install transfer heads on sampler. The heads are identical and can be installed on either end. The handles must be threaded all the way out before assembling.

Transferring Sample:

1. Install sampler on transfer apparatus. Handle on transfer head needs to be 4 inches off floor.
2. Place sample bottle on rack provided.
3. Connect tube #1, the one with the rotary coupling, to the transfer head at the top of the sampler. Connect tube #2 to the sample bottle. It will probably be necessary to reshape the tube to get it to fit. DO NOT ATTACH TUBE #3 at this time.

CAUTION:

For the transfer to be made correctly the valve positions listed in the instructions must be followed closely. Failure to do so can result in loss of the sample.

4. Set all valves, 1 through 8, in the closed position. The hand wheel pump should be threaded all the way in. The handles on the transfer heads are still threaded out.

5. Fill mercury funnel with mercury. Open valve #5. Open valve #7 a small amount. Mercury will flow from bleed tube. When Mercury flows, quickly close valve. To charge pump, rotate pump handle to left as quickly as possible. Turn it until it is all the way out. If the pump handle is rotated slowly the pump will not fill with mercury. To test pump charge, close valve #5. Rotate pump handle to right. It should start to build pressure within 4 rotations of the pump handle. If it does not, repeat the pump charging procedure. Release pressure by turning pump handle to left. Refill funnel with mercury. Open valve #5 & #6. Bleed the transfer head that is at the top of the sampler by opening the valve that is attached to it a small amount. When mercury flows close the valve. Rotate the sampler 180° by loosening the clamp and rotating the sampler and tube. Tighten the clamp. Attach tube #3 to the transfer head that is now on the top of the sampler. Open valve #1 and #2. Bleed mercury at valve #3 by opening it a small amount. Keep mercury funnel full of mercury. When mercury flows from valve #3 close it. Bleed valve #4 by opening it until mercury flows and then closing it. Close valve #5.

6. Transferring the Sample
Increase the system pressure by rotating the pump handle to the right until system pressure matches sample pressure. Usually this is known. However, if it is not, the sample pressure can be determined by carefully watching the system pressure on the dial gauge. When the system pressure and sample pressure are in equilibrium the pressure rise will occur much more slowly. Stop increasing the pump pressure at this time.

The transfer can now take place. Open sampler valve by rotating the handle on both the transfer heads to the right until they stop. If pressure is high, a considerable amount of force is required to rotate the handles. Transfer will now take place.

7. Completion

Transfer will usually take from 1 to 4 hours depending on the viscosity of the sample. It is possible to determine transfer completion time by putting a spring scale on the sample bottle. As the transfer is being made, the weight of the bottle will be reduced. When transfer is complete bottle will cease to lose weight.

8. Sample Bottle Removal

Close valves #1 & #2 (sample bottle). Reduce system pressure by turning pump handle to the left until it stops. Drain mercury from system by opening valve #4, then valve #7 and finally valve #8. Tapping the lines helps drain the mercury. Remove the sampler and shipping bottle.

HOW POISONOUS IS MERCURY? Bethlehem Apparatus Co., Hellertown, Pa.

*Mercury poisoning is insidious and its symptoms elusive.
Yet, proper precautions can assure safe laboratory working conditions.*

The most outstanding feature in surveying the copious literature on the subvergence of opinion is the conclusions that have been reached. As an example, we have one authority stating that mercury vapor in the minute amount of one microgram per cubic meter of air causes mercurialism, while an extended series of experiments by another investigator led to the conclusion that 1900 microgram caused no noticeable symptoms. A wide discrepancy is also found in the results of careful experimentation (1) which in one laboratory showed that subjects inhaling air containing the vapor absorbed 100% of the mercury, while in another (2) it was found that only 15% was so absorbed. From medical authorities we have conflicting statements; one report (2) states that practically all mercury excreted is found in the urine, although a second report (3) indicated that an equal amount is found in the urine and feces. As to the value of urinalysis as a test mercurialism we find some investigators (1) rely on this procedure to determine whether mild and questionable cases should be so classed, while others (4) bring out the fact that in obvious cases of poisoning less than half show any mercury at all in the urine.

This divergence of opinion is by no means due to the fact that the subject has not been carefully investigated. The findings of much carefully planned and executed research have been published. While the symptoms of Salivation caused by severe mercury poisoning, have long been known among miners, mercury smelters, and others who handle mercury in large quantities, the German chemist, A. Stock (1), was the first to focus public attention on the possibility that minute quantities of mercury vapor such as might be found in any laboratory could have detrimental effects. His chief reliance in demonstrating chronic mercurialism was on an extremely sensitive test he devised for determining mercury in the urine. When this was present along with other rather vague symptoms he diagnosed the case as one of chronic mercury poisoning, and it was he who reported that a microgram in a cubic meter of air is dangerous on long continued exposure.

Symptoms

In regard to symptoms there is no doubt as to the effects in the case of acute mercurialism. These include excessive flow of saliva (5, 6), vomiting, separation of teeth from gums and loss of teeth, diarrhea, and violent tremor. The more vague symptoms include forgetfulness (5, 6, 7), a strong disinclination to work, mental fatigue, irritability, excitability, headaches, digestive disturbances, timidity, loss of appetite, and the need for an unusual amount of dental work. It is obvious that any of these might very well be due to other causes, and therefore the work of Stock has not been taken as conclusive. In regard to mercury in the urine, it is interesting to note that with a test of the type he used, a positive result can be obtained in the most trivial contact with mercury or its compounds, such as the use of mercurochrome, mercury ointments, or even the commonly used surgical antiseptic, bichloride of mercury. If a tooth is filled with amalgam, an indication of mercury is obtained in the urine on the same day and persists for a week or more. At the present time no one believes that such observations have any practical meaning, although Stock's assumption that mercury in its vapor form is particularly dangerous is in general agreement with other authorities.

The present interest in mild cases of mercurialism is largely due to its incidence in the latter's industry. A carefully controlled set of experiments was carried out by Fraser et al. (5), at McGill University, with dogs exposed to various concentrations of mercury vapor for long periods of time. The investigators used enclosures about six feet square and four feet high, in each of which a dog was kept for eight hours a day. Air circulation was controlled so as to cause complete replacement in periods varying from three to twelve hours. For the lower concentrations of vapor, mercury was exposed in six pans one foot by a foot and a half. For the higher concentrations a circulation over mercury heated to as high as 90 was kept for eight hours a day. Air circulation was controlled so as to cause complete replacement in periods varying from three to twelve hours. For the lower concentrations of vapor, mercury was exposed in

six pans one foot by a foot and a half. For the higher concentrations a circulation over mercury heated to as high as 90°C was employed. They found that with 20,000 micrograms per cubic meter, dogs died in from one to three days. With 3000 micrograms the effects of poisoning were still observable, although dogs subjected to this exposure for a month subsequently recovered. With 1890 micrograms no effects at all were noticeable after forty days. By the use of valves to separate the inhaled and exhaled air, it was determined that the lungs absorbed about 25% of the vapor present. In regard to the urinalysis, the conclusion was that results varied greatly from day to day, so that an average over a period of six days was required and that about 500 micrograms per liter should indicate the presence of mercury poisoning.

Rates of Incidents in Hatters' Industry

Extensive researches (4) have been made of conditions in the hatters' industry, both in New Jersey and Connecticut. In the treatment of the pelts, nitrate of mercury is applied at an early stage of the process and therefore persists in the subsequent operations. Not only is there direct contact with the skin of workers, but there is a large quantity of mercury-laden dust and vapor in the air. According to Neal et al., of the U.S. Department of Health Service, measured concentrations of vapor in a number of plants ran as high as 670 micrograms, and for many of operations the amount was in the neighborhood of 300. Of the large number of workers examined, most of them with long terms of service, it was found that about 8% could be diagnosed as suffering from chronic mercurialism. Clark Goodman (6) of the Massachusetts Institute of Technology, using this study and others, concludes that for periods for exposure for months or years, a concentration of greater than 250 micrograms is dangerous. Since this is only about one fiftieth of the equilibrium concentration of vapor at 70° F, it is apparent that higher concentrations might be suspected in a laboratory where mercury is carelessly handled. The National Institutes of Health set the permissible limit of mercury vapor in air as 100 micrograms per cubic meter.

C.F. McCarroll (8) (Bureau of Mines Report T.I. 3475) carried out experiments on the concentration of mercury vapor in a number of petroleum laboratories. Working with a selenium sulfide type of detector (9) he found that in some rooms kept closed at rather high temperatures for long periods, concentrations as high as 700 micrograms could be observed. The average was, of course, very much lower.

Shepherd (7) et al., of the National Bureau of Standards, in an investigation of some 60 government laboratories, using the more sensitive Woodson detector (10), found average concentrations of from four to 70 micrograms. The higher figures applied to rooms where the conditions were decidedly poor; for instance one room, unventilated, had a tinned floor amalgamated with mercury, while another with poor ventilation had mercury in the cracks of the wooden floor, and pools under base boards. Neither McCarroll nor Shepherd found any cases of mercurialism among the workers of these laboratories.

In view of the recognized danger a large number of precautions have been recommended in the published literature among which are the following:

- Insure good ventilation (1, 3, 4, 9, 10, 11)
- Store all mercury in tight containers or under water.
- Where mercury spillage occurs, immediately flood the areas with water, wear rubber boots, remove the mercury with a suction pump (8, 11)
- Rinse mouth before taking a drink or eating.
- Have separate lockers for working clothes and street clothes, the latter in a mercury free room (8, 11)
- Eat a heavy meal before handling mercury and take a hot bath after the day's work (8, 11).
- Wear gas mask and rubber gloves, and work under a hood.
- When working with mercury apparatus (6, 7, 11), wash hands before eating and do not smoke (8, 11) or have food in rooms where there is mercury.
- Have dental and medical examinations at frequent intervals (8, 11)

These precautions undeniably are desirable and would virtually eliminate the danger from poisoning. It is the author's strong impression, however, after close association with the numerous large and small laboratories where mercury is present in quantities, that many of these suggestions will not be followed. Some are not practicable for general application, and since there are so few, if any, definite cases where laboratory workers handling mercury at room temperatures have suffered ill effects, it is difficult to make a convincing argument for their necessity. However, two points must be borne in mind; the first is that mercury volatilizes at room temperature, and secondly, the vapor is poisonous. The clinical symptoms for mild cases are vague and may be attributable to other causes, making it impossible to prove that low concentrations are detrimental. On the other hand, it is equally impossible to prove in a given case that various disorders are not due to this cause. It may very well be that in many cases laboratory workers are actually suffering from ailments which result from contacts with the vapor. It is suggested that there are various measures which are reasonable and should certainly be observed as far as possible. Among these are the need for adequate ventilation and careful handling. Floors and tables should be smooth and free from cracks and recesses where mercury can lodge. Where quantities are used, the author has found that working on a tabletop made of slats with a sloped tray below which drains into a bottle, is a convenient arrangement. Spilled mercury should be collected with a vacuum suction bottle or a so-called "mercury magnet," which is a spiral of copper wire treated with nitric acid and then amalgamated. This will pick up even the tiniest droplet.

Dry sweeping should be avoided. It is very little trouble to use sweeping compounds or to dampen the floor. It is impossible to clean off all the mercury from the average surface, as has been shown by Shepherd. He discovered that when a cigarette was tapped before lighting on an apparently clean table, mercury droplets visible only under a microscope had been picked up by the tobacco. Since mercury cannot be completely removed mechanically, chemical washes have been suggested. A little caustic soda and sulfur in a gallon of water is effective to change the droplets to a non-volatile sulfide. Sulfur may also be mixed with the sweeping compound for the same purpose. A patented process, No. 2320468, contemplates coating walls and other surfaces with a sulfur bearing material, and a second patent, No. 2300965, covers using a spray of soluble sulfur compound, such as calcium polysulfide.

Precautions in Distillation

Distillation of mercury should be carried out with great precautions, since vapor pressure rises rapidly with temperature. In one case which was called to the author's attention, a vacuum still operating in a room where a number of men were working, leaked so badly that a white sublimate of condensed mercury was noticed on objects in the room before the leak was discovered. A piece of apparatus of this sort should be used only in a separate, well-ventilated room and according to Shepherd, the exhaust of the oil pump creating the vacuum should discharge outside. Crudely constructed apparatus should never be used. Leaky joints and poor condensers are particularly dangerous. In cleaning mercury with nitric acid, it is usually washed, then dried with heat. This last should be carried out under a well ventilated hood or in an oven with an external exhaust; or even better, by passing the mercury through a filter constructed for separating out moisture.

Purification of Mercury

Mercury should always be used in a clean condition. If it contains dissolved base metals it forms a skin which will cling to the hands, clothing and apparatus. Purification can be carried out by distillation, nitric acid was, certain electrolytic processes and, more recently, oxidation of the base metals with air. The latter is accomplished, in a few instances by bubbling air through the mercury for long periods, with a layer of water to prevent escape of vapor and minute particles into the room. This type of purification is carried out on a practical basis by a moto-driven unit in which a fine spray is produced in a closed cylinder (12). After distillation, air oxidation, or, in general, wherever dust, oil, water, or acid has come into contact with the mercury, it must be filtered. This may be done by squeezing it through a cloth or chamois skin or running it over filter

paper. These operations involve handling and in the case of cloth or paper the materials must be disposed of without burning, as they contain quantities of mercury droplets. A fritted glass filter or device such as the gold-adhesion filter is preferable.

Although large doses of mercury vapor can cause poisoning immediately, the principal danger arises from contact with low concentrations for long periods of time. Various forms of detectors have been devised; for instance, one employs a paper impregnated with selenium sulfide exposed to the atmosphere and indicates the presence of mercury vapor by turning dark in color; another uses a photo cell and a source of ultra-violet light which is scattered by mercury vapor and the result read on a scale. The employment of detectors will give assurance that safe working conditions are maintained.

Literature Sited

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