BASIN WATER MANAGEMENT PROJECT

MAINTENANCE AND TESTING OF DOMESTIC WATER METERS

A TRAINING/JOB MANUAL

BY

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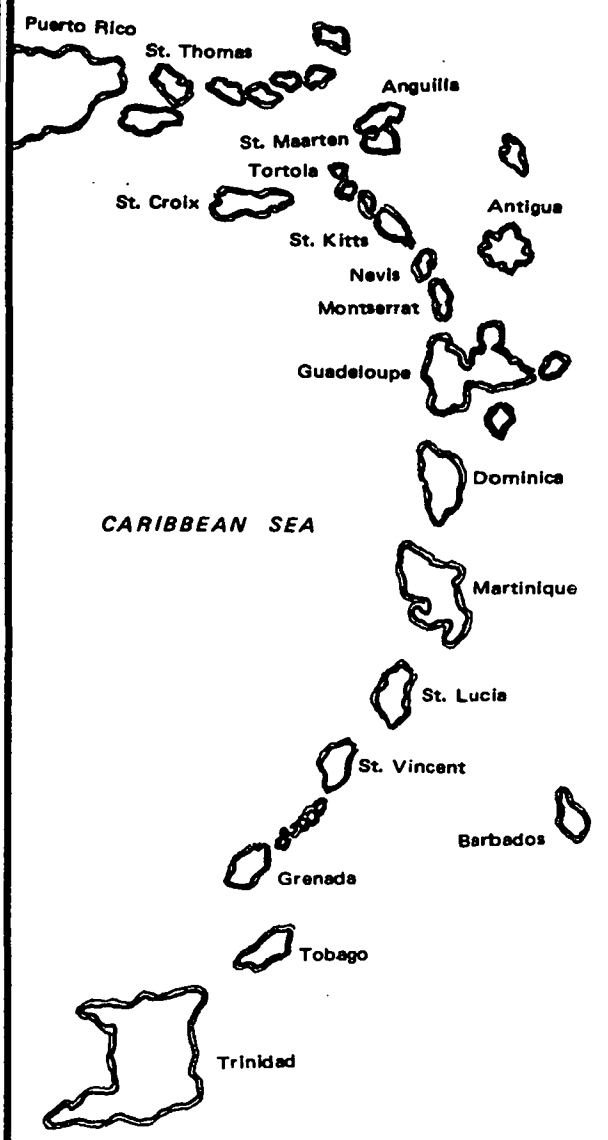

A JOINT-VENTURE PROJECT OF THE GOVERNMENTS OF:

ANGUILLA, ANTIGUA, BRITISH VIRGIN ISLANDS, BARBADOS, DOMINICA, GRENADA, MONTSERRAT, ST. KITTS/NEVIS, ST. LUCIA, ST. VINCENT, CANADA, UNITED KINGDOM

AND

THE PAN AMERICAN HEALTH ORGANIZATION

NOV. 1979

CARIBBEAN BASIN WATER MANAGEMENT PROJECT

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PREFACE

PURPOSE OF TRAINING/JOB MANUAL

MAINTAINING EFFECTIVE AND EFFICIENT ON-THE-JOB PERFORMANCE SHOULD BE THE AIM OF NOT ONLY EVERY SUPERVISOR AND FOREMAN BUT ALSO OF EVERY WORKER. FREQUENTLY SOME IMPROVEMENT IN PERFORMANCE IS NOTED AFTER TRAINING. OVERTIME, HOWEVER, PERFORMANCE OFTEN DECREASES TO, OR BELOW THE ORIGINAL LEVEL. ONE WAY TO SET STANDARDS OF PERFORMANCE AND TO SUGGEST METHODS OF ATTAINING THE DESIRED PERFORMANCE SO THAT IT IS CLEAR TO THE WORKER, THE SUPERVISOR OR FOREMAN AS WELL AS THE TRAINER, IS TO PROVIDE A TRAINING/JOB (T/J) MANUAL WHICH CLEARLY STATES THE DESIRED PERFORMANCE AND SUGGESTS PROCEDURES FOR THE WORKER TO ATTAIN THIS LEVEL OF PERFORMANCE. THE FOLLOWING T/J MANUAL DOES JUST THIS.

HOW TO USE THE TRAINING/JOB MANUAL

THE MATERIALS THAT FOLLOW CAN BE USED IN A NUMBER OF DELIVERY SYSTEMS, DEPENDING ON THE NATURE OF PERFORMANCE THAT NEEDS TO BE IMPROVED. IF THE TRAINEES ARE NEW TO THE SUBJECT MATTER, THE T/J MANUAL CAN BE USED IN A FORMAL TRAINING SYSTEM. THERE ARE SUFFICIENT DETAILED DESCRIPTIONS OF SUPPLIES AND MATERIALS AS WELL AS TRAINING ACTIVITIES TO GUIDE THE TRAINER.

A SUPERVISOR, FOREMAN OR TRAINER REQUIRED TO DIAGNOSE PERFORMANCE DEFICIENCIES, CAN USE THE OPERATION BREAKDOWN SHEET AS A REFERENCE TO IDENTIFY THE AREA OF PERFORMANCE DEFICIENCY. HE CAN THEN CONCENTRATE TRAINING ON THIS PARTICULAR AREA BY USING THE APPROPRIATE SECTIONS OF THE T/J MANUAL AS A GUIDE.

WORKERS WHO ARE EAGER TO MOVE AHEAD IN ACQUIRING NEW KNOWLEDGE AND SKILLS COULD USE THE T/J MANUAL, ALONG WITH ASSISTANCE FROM FELLOW WORKERS WHO ARE KNOWLEDGEABLE IN THE SUBJECT AREA, TO STUDY THE MATERIAL ON THEIR OWN.

THE T/J MANUAL IS DESIGNED TO BE USED ON-THE-JOB AS A READY REFERENCE AS NEEDED. IN MANY CASES, THE JOB-AIDS CAN BE LIFTED FROM THE MANUAL AND POSTED DIRECTLY AT THE SITE WHERE THE PERFORMANCE IS TO TAKE PLACE AS A CONSTANT REMINDER TO THE WORKER OF THE PROPER PROCEDURE FOR A TASK.

WHERE TO GET MORE INFORMATION

THIS T/J MANUAL IS ONE OF MANY BEING DEVELOPED BY THE CARIBBEAN BASIN WATER MANAGEMENT PROJECT TO IMPROVE THE PERFORMANCE OF PERSONNEL IN THE WATER UTILITIES OF THE EASTERN CARIBBEAN. MANUALS WILL BE DEVELOPED IN MANY ASPECTS OF WATER UTILITY OPERATION, MAINTENANCE, AND ADMINISTRATION. FOR MORE DETAILS ON MANUAL AVAILABILITY AND OTHER ASPECTS OF THIS PROJECT CONTACT:

ENGINEER NEIL F. CAREFOOT, MANAGER
CARIBBEAN BASIN WATER MANAGEMENT PROJECT
PAHO/WHO,
BRIDGETOWN, BARBADOS.

ACKNOWLEDGEMENT

This Manual has been prepared for the training of personnel in the Water Authority whose responsibility is to maintain and test Kent Domestic Water Meters. A sincere effort was made to present both technical and basic information in a manner to help the individual understand and follow procedures.

I am grateful to the people who gave me the opportunity to develop and prepare this training/job manual. Special mention must be made of Engineer Neil F. Carefoot, Quincy Francis, (Jamaica), Jeffrey Barrow, Henderson Greenidge, and Graphic Artist Miss Rosemary Deane (Barbados); also the Antigua Public Utilities Authority and the Management and advisers to Caribbean Basin Water Project sponsored jointly by PAHO/WHO - CIDA.

Signed,

Charles Winston Ramsay,
Instrumentation/Laboratory Technician.

Glossary of Technical Terms

Anticlockwise	-	Going in the opposite direction travelled by the hands of a clock
Aperture	-	Opening
Clockwise	-	Going in the direction travelled by the hands of a clock
Concentrated Hydrochloric Acid	-	Hydrochloric acid of maximum strength
Component	-	A seperate recognisable part of something
Compress	-	To press together
Coupling	-	A linking device
Calibrated	-	The adjust the scale of measuring instrument to correct units
Distilled water	-	Water which does not contain any impurities such as dissolved metals
Dilute acid	-	Acid of less strength than concentrated acid because water (usually distilled) was added
Eliminate	-	To remove from
Effervescence	-	To issue out in bubbles, as a gas
Gears	-	Mechanical assembly of interacting parts that serves to transmit motion
Guage	-	A device for measuring
Mixture	-	A blend of two substances
Mould	-	A form that gives a particular shape
Pressure	-	The force acting over a unit area of surface
Percentage Error	-	The error express as a percentage of the actual quantity - See formula

Glossary of Technical Terms (cont'd)

Quantity passed	-	A measure of the quantity of water which actually flows through the meter
Quantity registered	-	The numerical figure of the gallons passed which is read from the meter
Ridges	-	Long relatively narrow sides of the part
Registered	-	Recorded
Scored	-	Mark with cuts or lines
Smear	-	To spread or cover
Shaft	-	Usually a cylindrical rod which turns or about which other parts turn
Solution	-	Liquid which is the same throughout a and which is produced when two or more substances are mixed
Specific Gravity	-	The mass of a given volume of a substance compared to the mass of an equal volume of water
Terterate Indicator	-	An instrument to measure flow of a liquid
Valve	-	An instrument that regulates the amount and direction of flow of a liquid, gas or loose material

Formula : $\text{Percentage Error} = \frac{(\text{Quantity Passed} - \text{Quantity Registered})}{\text{Quantity Passed}} \times 100$

TRAINING/JOB MANUAL — Maintenance and Testing of Domestic Water Meters

WHAT IS THIS MANUAL ALL ABOUT?

This Manual is about the dismantling, cleaning, examining, reassembling and testing procedures of a Kent Domestic Water Meter.

WHY DOES THE TRAINEE NEED THIS?

The accuracy of a Water Meter is a matter of dollars and cents to the customer and the utility. Over-registration charges the customer for water not received; under registration cheats the utility of its due income.

The accuracy of the water meter is to a large extent dependant on the proper maintenance of the unit. Consequently, it is important that the trainee become thoroughly familiar with all maintenance operations.

WHAT DOES THE TRAINEE NEED TO KNOW BEFORE BEGINNING?

Be able to:

1. Read and interpret charts and diagrams.
2. Read fluently and effectively.
3. Make reliable visual discriminations.

WHAT SUPPLEMENTARY MATERIALS WILL HELP?

Kent Domestic Water Meter - Technical Manual - New Edition.

WHAT ARE THE OBJECTIVES?

1 Explain and demonstrate how to secure counter end in vice, unscrew housing and to lift out working chamber.

2 Identify relevant parts of the meter and remove the piston and strainer.

3 Remove the counter retaining ramp and counter unit, identify the parts of a water meter.

4 Preparing 1:1 dilute Hydrochloric acid solution - specific gravity 1.6.

5 Demonstrate and explain the procedure for immersing, removing and rinsing the meter components.

6 Demonstrate and explain how to check each component of a water meter for wear.

7 Demonstrate the preparation of a work-bench and secure the housing in the vice.

8 Demonstrate and explain the procedure for fitting and locking the counter unit in position.

9 Demonstrate and explain the insertion of a flow strainer and the locking of it with a circlip.

10 Demonstrate and explain the insertion of the piston in place and the placing of top plate on the chamber.

11 Demonstrate and explain how to place complete working chamber in meter housing and screw on chamber housing.

12 Check the test apparatus and attach the water meters.

13 Demonstrate and explain the procedure for applying flow pressure and adjusting and recording flow rates.

14 Calculate the percentage error on the water meter.

WHAT EQUIPMENT AND SUPPLIES ARE NEEDED?

ITEM	LESSONS															
	1.1	1.2	1.3	2.1	2.2	2.3	3	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4
Meter case			x						x	x	x	x				x
Meter Components			x				x		x	x	x	x				
Old meter							x									
Hydrochloric Acid SP.GR 1.16				x												
Acid Solution 1:1					x	x										
Apron				x												
Rubber Gloves				x												
Plastic Mask				x												
Graduated Cylinder				x												
Plastic Container				x												
Sink				x												
Deionized water				x												
Ice				x												
Bath				x	x	x										
Copper wire					x											
Stop cock						x										
Brush						x	x									
Tap & Running Water						x										
Cloth									x							
Paper									x							
Air source									x							
Soap Water									x							
Test Bench													x	x	x	

WHAT EQUIPMENT AND SUPPLIES ARE NEEDED? (*Cont'd*)

ITEM	LESSONS															
	1.1	1.2	1.3	2.1	2.2	2.3	3	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4
Calibrated Tank														x	x	
Test Guages														x		
Note book	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pencil	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Lithum Listate Grease									x							
Tool Kit:	x				x	x	x					x	x	x	x	
Combination Pliers																
Smooth Jowed Pliers																
Screw driver																
Hammer (Plastic Head)																
Utility Tongs																
Meter cover wrench																
Adjustable wrench																
Work Bench	x						x	x								
Vice	x							x								
Water Meter	x	x	x										x			
Black Board	x	x	x	x			x	x	x	x	x					x
Chalk	x	x	x	x			x	x	x	x	x					x

TRAINING/JOB MANUAL — Maintenance and Testing of Domestic Water Meters

LESSON 1.1  *SECURING THE COUNTER END IN THE VICE AND REMOVING THE WORKING CHAMBER ASSEMBLY*

ESTIMATED TIME — 20 minutes

PREREQUISITES — Trade School Certificate

PERFORMANCE OBJECTIVE:

- The trainee will <u>be able to</u>:

  explain and demonstrate how to secure counter end in vice, unscrew housing and to lift out working chamber.

- Under the following <u>condition</u>:

  given work bench, vice and water meter.

- To this <u>standard</u>:

  operation is to be carried out in accordance with procedures outlined.

TRAINING RESOURCES

Supplies and Equipment:	Work Bench, tools, vice and water meter, blackboard and chalk.
Information Sheets:	L1.1:IS:01, L1.1:IS:02, L1:1:IS:03, L1.1:IS:04.
Work Sheet:	L1.1:WS:01.

TRAINING ACTIVITIES

TRAINER ACTIVITY	TRAINEE ACTIVITY
1. Trainer reviews procedure outlined in Operation Breakdown sheet. Refer to L1.1:IS:01.	1. Trainees review procedure outlined in Operation Breakdown Sheet. Refer to L1.1:IS:01.
2. Trainer demonstrates the procedure outlined in Operation Breakdown Sheet L1.1:IS:01 and list name of parts on chalk board. Refer to L1.1:IS:01 - 04.	2. Trainees observe and label L1.1:WS:01.
3. Trainer supervises the trainees during the practice of the procedure.	3. Trainees practice the procedure under the supervision of the trainer.

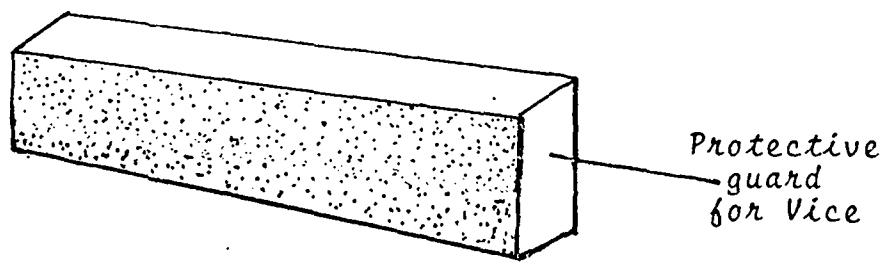
OPERATION BREAKDOWN SHEET

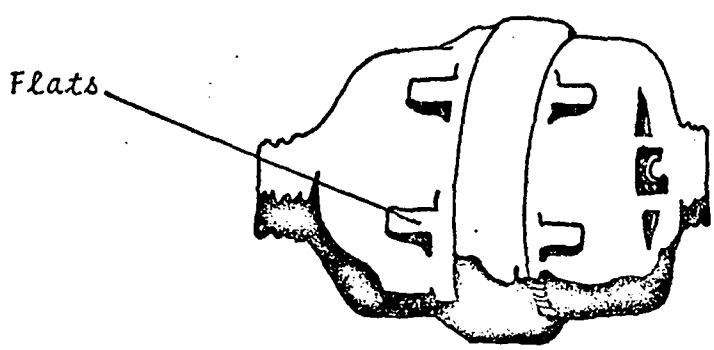
L1.1:IS:01

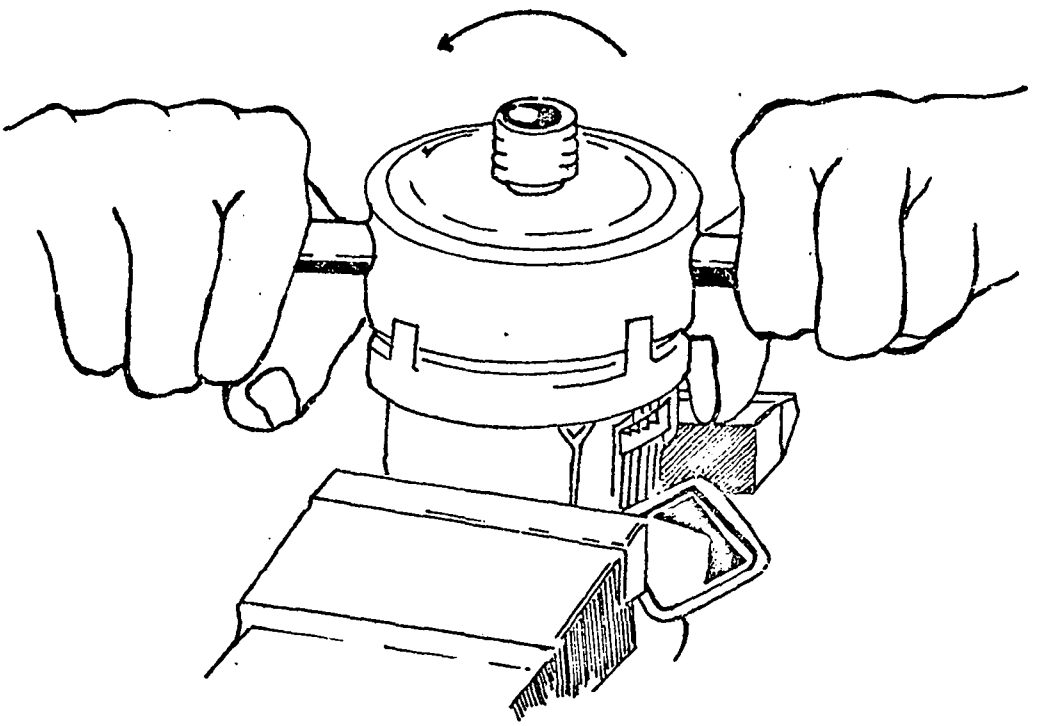
POSITION *Meter Repair Assistant* TASK *Dismantling a meter*

OPERATION *Securing counter end in vice and removing the working Chamber assembly*

Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
1. Secure counter end.	1.1 Use protective guard on bench vice jaws. 1.2 Point out the flats - vice jaws should grip flat on meter body. 1.3 Turn handle clockwise to screw in bench vice jaws.
2. Unscrew housing.	2.1 Fit tool on meter - slots on tool should fit slots on meter. 2.2 Unscrew the chamber - hold both ends of the tool and turn anticlockwise. 2.3 Take care not to damage body sealing ring.
3. Lift out working assembly.	3.1 Remove meter cover. 3.2 Lift out working assembly - use fingers.

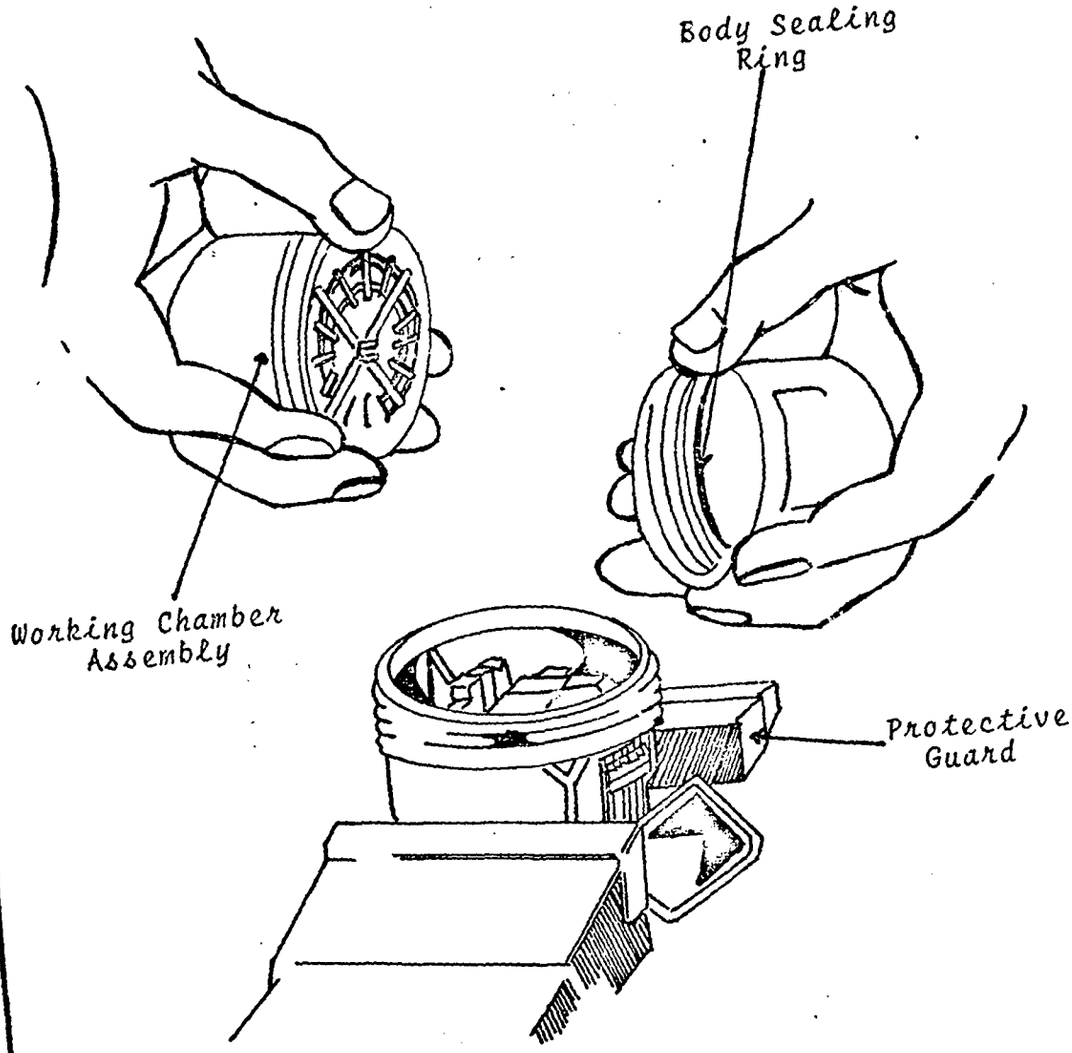

Protective
guard
for Vice


Flats

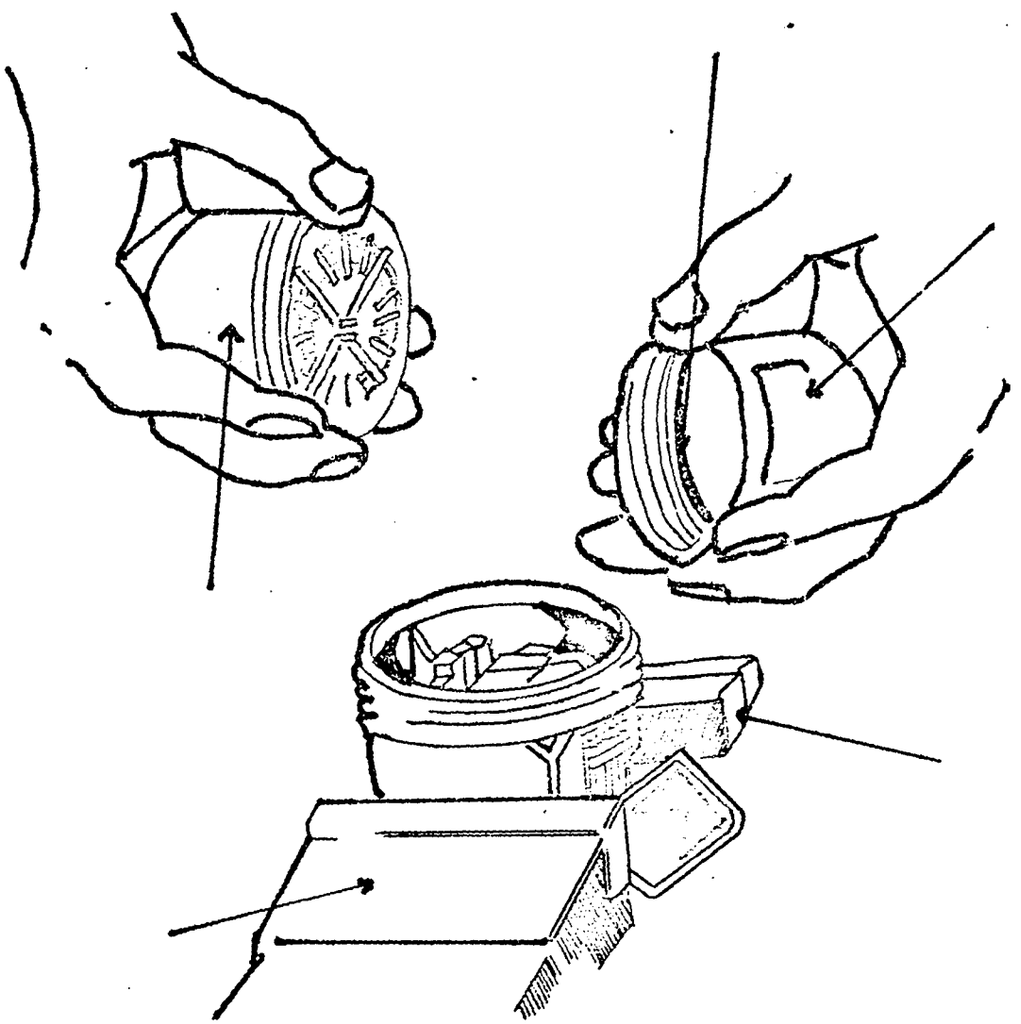


UNSCREWING HOUSING

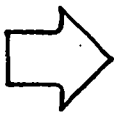
TURN ANTICLOCKWISE



LIFTING OUT WORKING CHAMBER ASSEMBLY



TRAINING/JOB MANUAL — Maintenance and Testing of Domestic Water Meters

LESSON 1.2  *IDENTIFYING RELEVANT PARTS AND REMOVING THE PISTON AND STRAINER*

ESTIMATED TIME — 20 minutes

PREREQUISITES — Lesson 1.1

PERFORMANCE OBJECTIVE:

- The trainee will <u>be able to</u>:

  identify relevant parts of the meter and remove the piston and strainer.

- Under the following <u>condition</u>:

  given meter with internal parts and illustrated picture handout.

- To this <u>standard</u>:

  operation is to be carried out in accordance with procedures outlined.

TRAINING RESOURCES

Supplies and Equipment:	Work bench, tool kit, vice and water meter, chalk board.
Information Sheets:	L1.2:IS:01, L1.2:IS:02, L1:2:IS:03, L1.2:IS:04.
Work Sheet:	L1.2:WS:01.

TRAINING ACTIVITIES

TRAINER ACTIVITY	TRAINEE ACTIVITY
1. Trainer and trainees review the procedure outlined in the Operation Breakdown Sheet L1.2:IS:01.	1. Trainees and Trainer review the procedure outlined in the Operation Breakdown Sheet L1.2:IS:01.
2. Trainer demonstrates the procedure and lists the name of the parts on the chalk board. Refer to L1.2:IS:01 - 04.	2. Trainees observe the procedure, identify the parts and label L1.2:WS:01.
3. Trainer supervise trainees during the practice of the procedure.	3. Trainees practice the procedure under the supervision of the trainer.

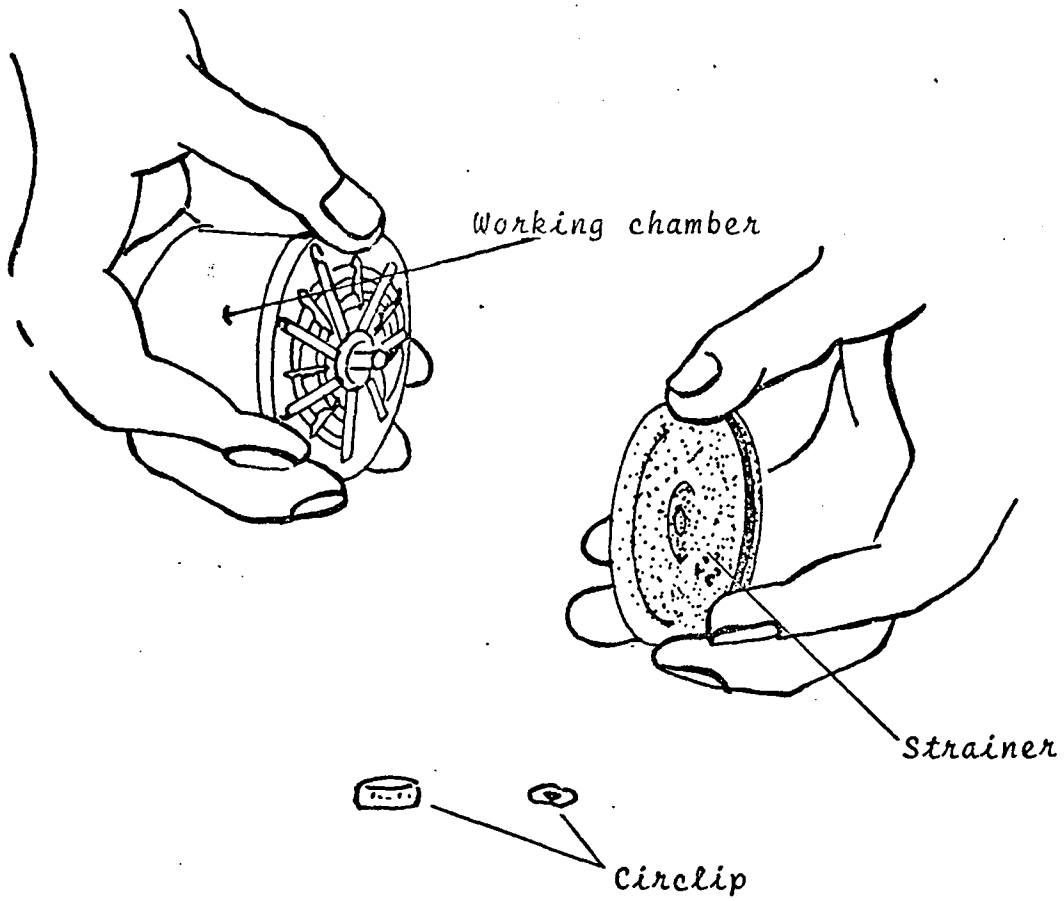
OPERATION BREAKDOWN SHEET

L1.2:IS:01

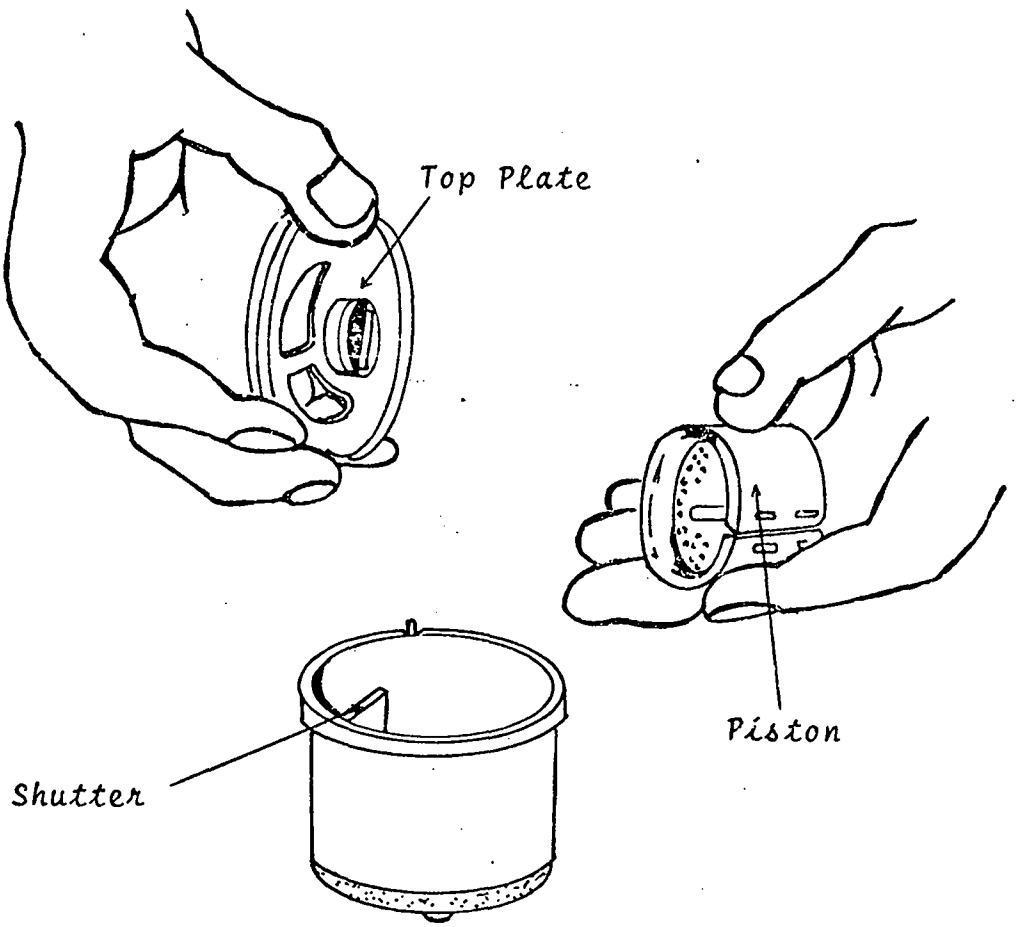
POSITION *Meter Repair Assistant* TASK *Dismantling a Meter*

OPERATION *Removing the Piston and Strainer*

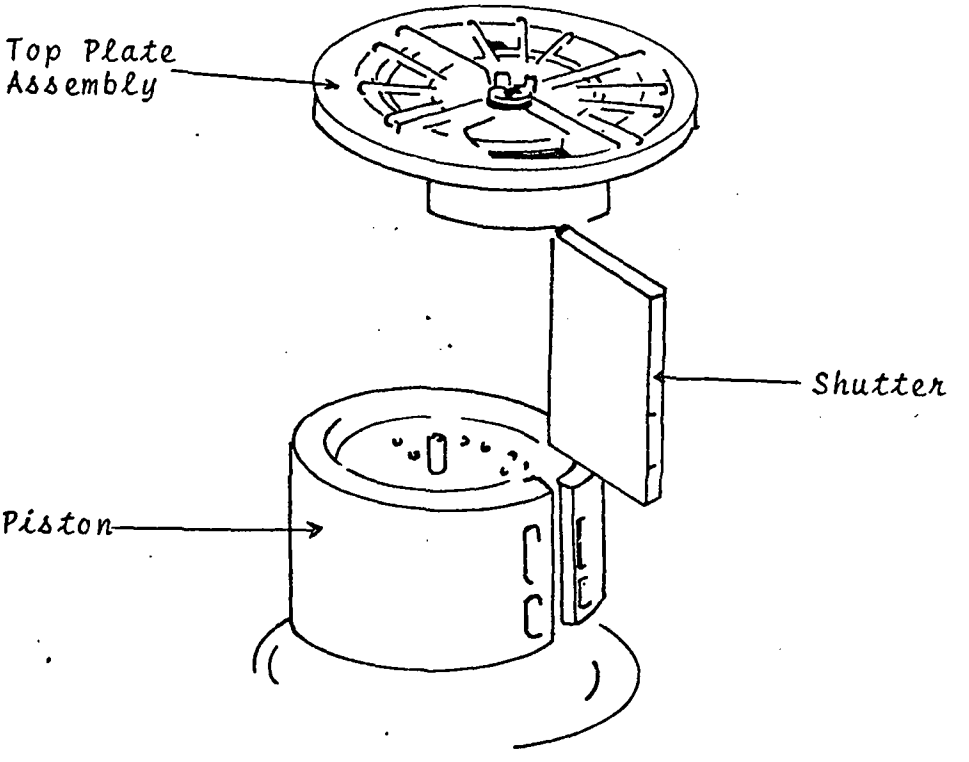
Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
1. *Lift out the piston.*	1.1 *Remove the working chamber assembly.* 1.2 *Use fingers to remove the top plate.* 1.3 *Use fingers to lift out the piston.* 1.4 *Use fingers to remove shutter.*
2. *Remove the strainer.*	2.1 *Locate the spigot.* 2.2 *Use pliers to release the circlip.* 2.3 *Use fingers to remove the strainer from the assembly.*



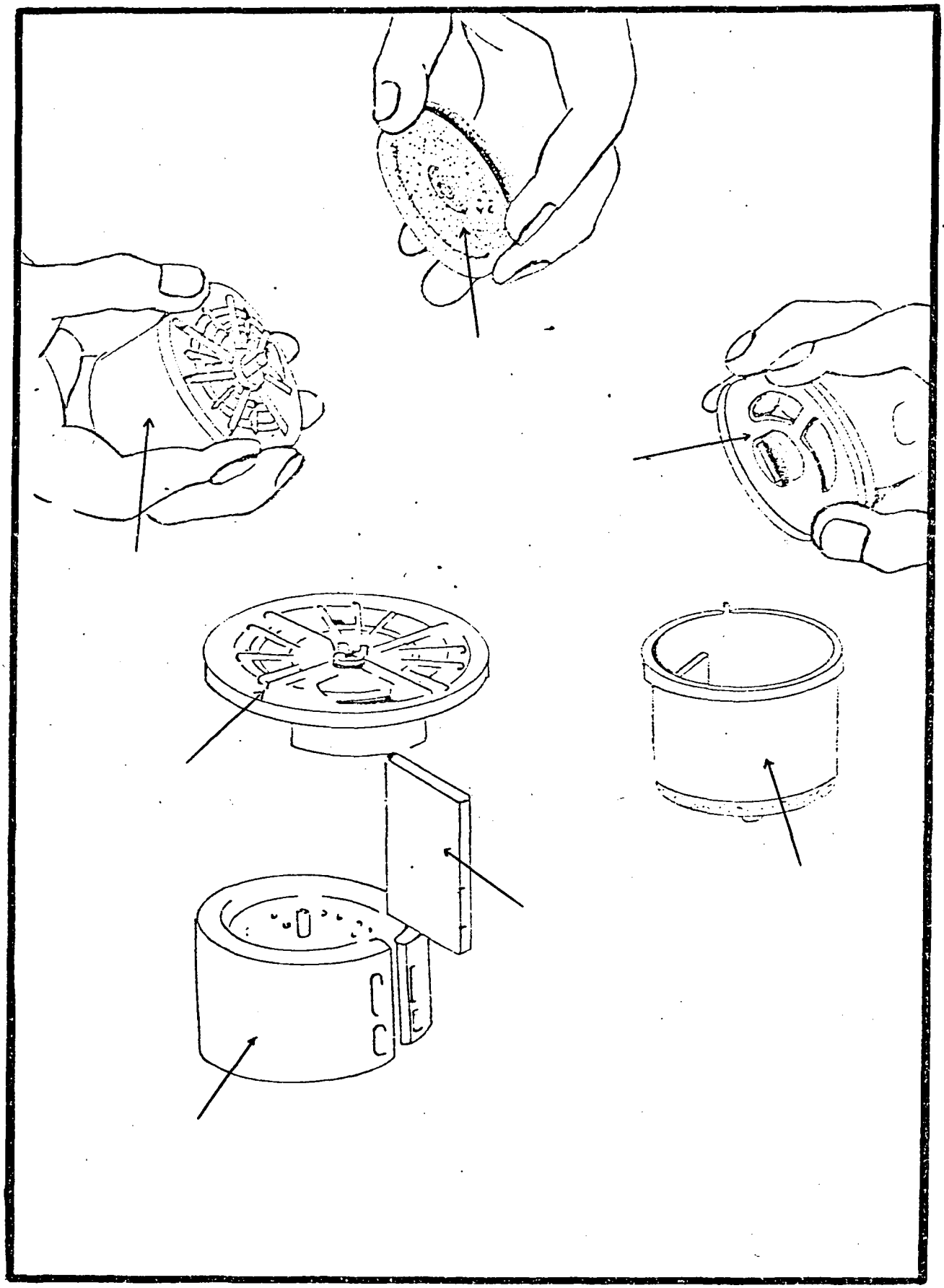
REMOVING STRAINER



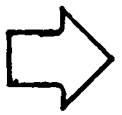
REMOVING PISTON



REMOVING TOP PLATE ASSEMBLY



TRAINING/JOB MANUAL — Maintenance and Testing of Domestic Water Meters

LESSON 1.3  *REMOVING THE COUNTER RETAINING RAMP AND COUNTER UNIT*

ESTIMATED TIME — 20 minutes

PREREQUISITES — Lesson 1.1

PERFORMANCE OBJECTIVE:

- The trainee will be able to:

  remove the counter retaining ramp and counter unit; identify the parts of a water meter.

- Under the following condition:

  given meter casing with counter retaining assembly, counter unit and illustrated pictures.

- To this standard:

  operation is to be carried out in accordance with procedures outlined.

TRAINING RESOURCES

Supplies and Equipment:	Work bench, tool kit, vice, water meter, black board and chalk.
Information Sheets:	L1.3:IS:01, L1.3:IS:02 L1.3:IS:03, L1.3:IS:04
Work Sheet:	L1.3:WS:01.

TRAINING ACTIVITIES

TRAINER ACTIVITY	TRAINEE ACTIVITY
1. Trainer reviews the procedure outlined in Operation Breakdown Sheet L1.3:IS:01.	1. Trainees review the procedure outlined in Operation Breakdown Sheet L1.3:IS:01.
2. Trainer explains and demonstrates the procedure; also lists the names of the parts on the chalk board. Refer to L1.3:IS:01-03.	2. Trainees listen and observe.
3. Trainer supervises trainees during the practise of the procedure.	3. Trainees practise the procedure under the supervision of the trainer.
4. Trainer displays all components of a water meter - refer to L1.3:WS:01.	4. Trainees identify and name components - L1.3:WS:01.
5. Trainer distributes L1.3:IS:04.	5. Trainees read L1.3:IS:04 and compare with L1.3:WS:01.

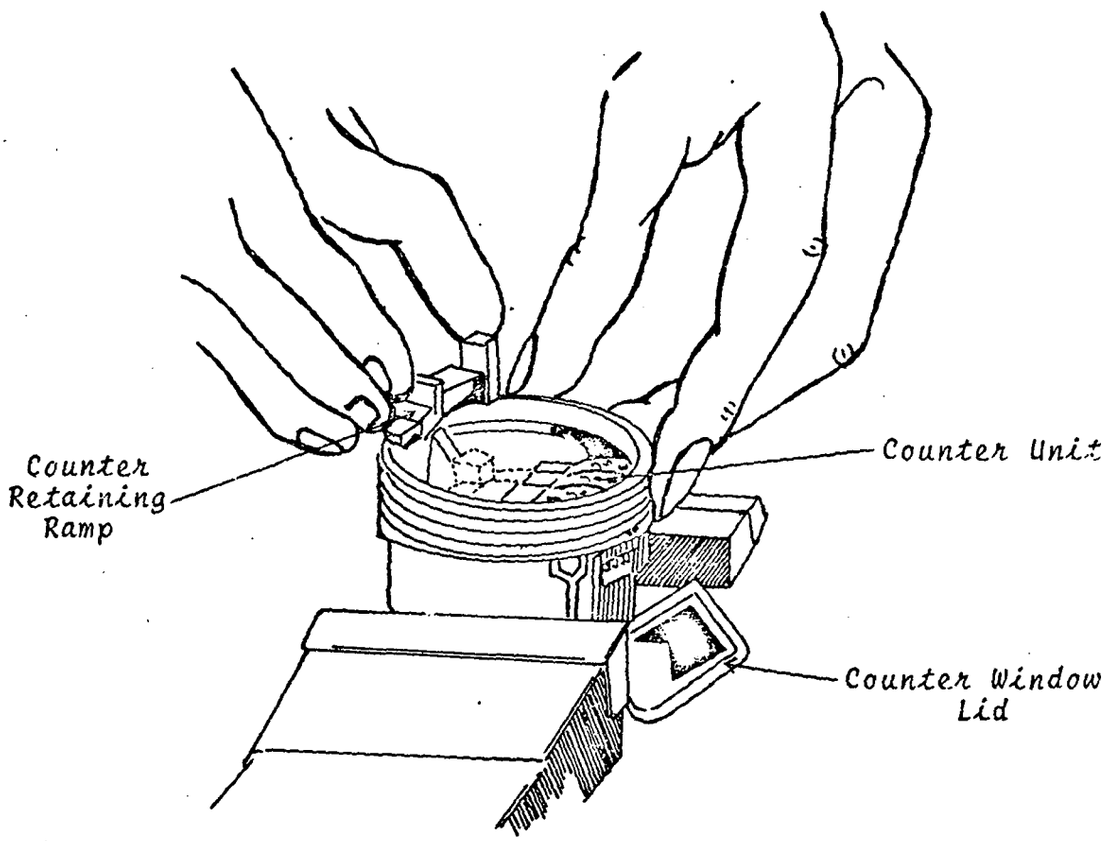
OPERATION BREAKDOWN SHEET

L1.3:IS:01

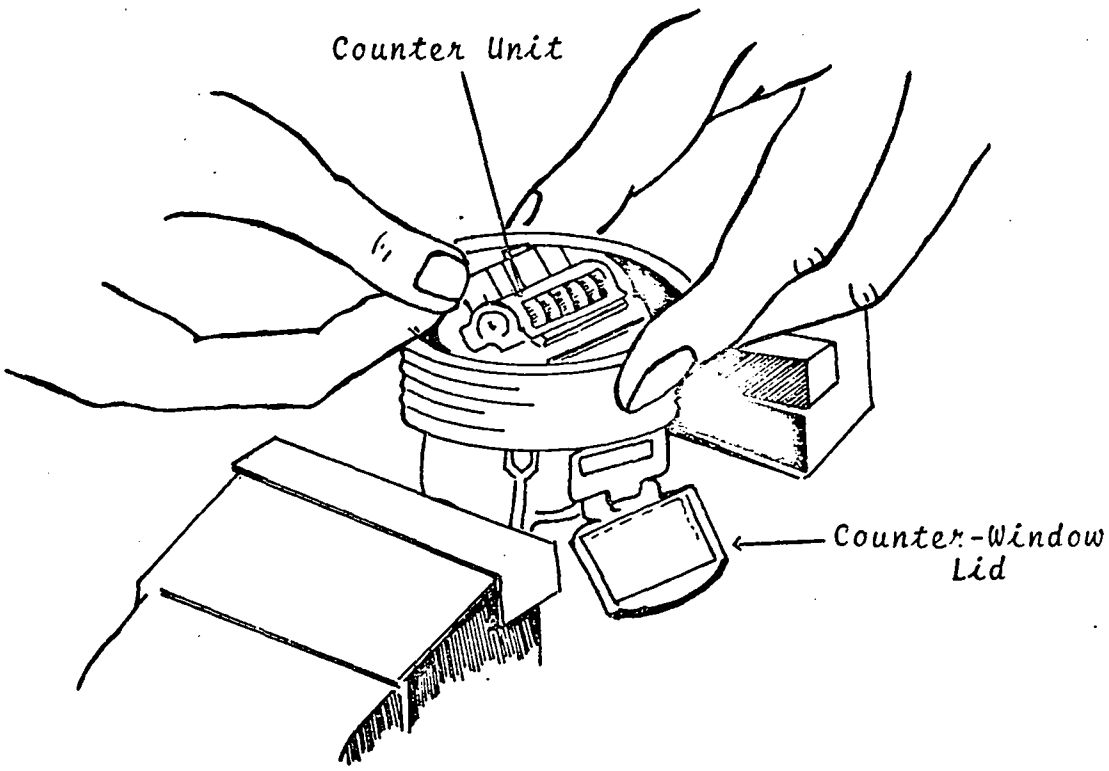
POSITION: Meter Repair Assistant TASK: Dismantling a Meter

OPERATION: Removing the counter retaining ramp and counter unit

Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
1. Remove the counter retaining ramp assembly.	1.1 Use fingers and lift out Ramp assembly. 1.2 Observe spring loaded arrangement.
2. Withdraw counter unit.	2.1 Use fingers and lift out counter unit. 2.2 Be careful not to damage gears. 2.3 Observe seating position.
3. Remove counter housing from vice.	3.1 Turn vice handle anticlockwise. 3.2 Use hands to lift out housing.

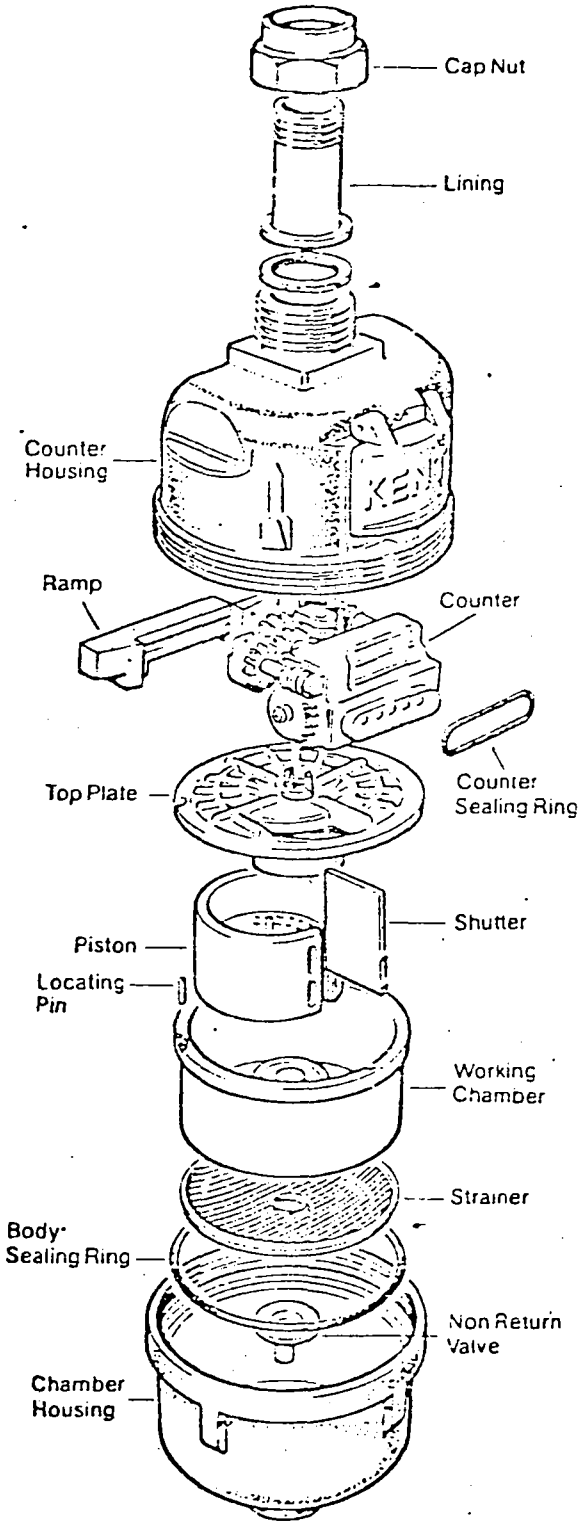


REMOVING COUNTER RETAINING RAMP



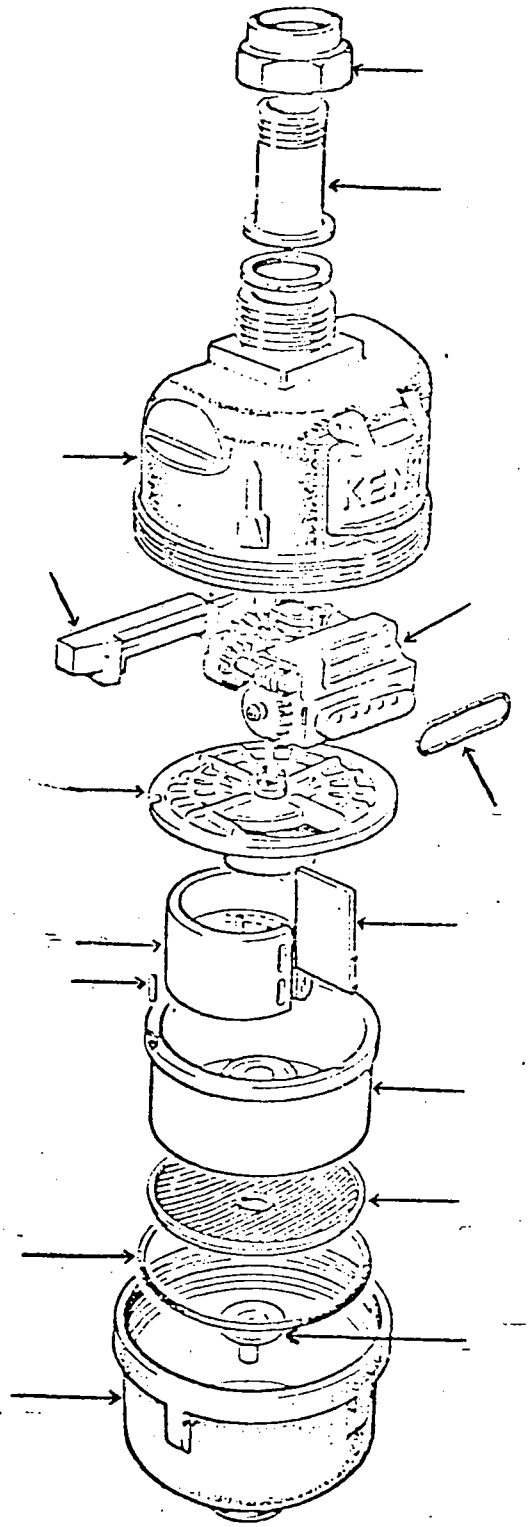
REMOVING COUNTER UNIT

KENT
PSM
WATER METER

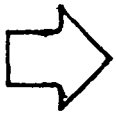


INTERNAL AND EXTERNAL PARTS OF A KENT WATER METER

KENT
PSM
WATER METER



TRAINING/JOB MANUAL — Maintenance and Testing of Domestic Water Meters

LESSON 2.1  *PREPARING 1:1 DILUTE HYDROCHLORIC ACID SOLUTION - SPECIFIC GRAVITY 1.16*

ESTIMATED TIME — 30 minutes

PREREQUISITES — Ability to measure liquids using a graduated cylinder

PERFORMANCE OBJECTIVE:

- The trainee will be able to:

  mix a 1:1 dilute hydrochloric acid solution - specific gravity 1.16.

- Under the following condition:

  given the equipment listed in equipment and supplies below.

- To this standard:

  there must be 100% accuracy.

TRAINING RESOURCES

Equipment and supplies: Hydrochloric acid (specific gravity 1.16, apron, rubber gloves, plastic face mask, graduated cylinder, plastic container, sink, distilled water and ice.

Information Sheet: L2.1:IS:01, L2.1:IS:02, L2.1:IS:03, L2.1:IS.04, L2.1:IS:05, L2.1:IS:06.

TRAINING ACTIVITIES

TRAINER ACTIVITY	TRAINEE ACTIVITY
1. Read and discuss the procedure - L2.1:IS:01. Emphasise the safety measures - L2.1:IS:05-06.	1. Read and discuss the procedure - L2.1:IS:01.
2. Demonstrate and explain the procedure - L2.1:IS: 01-04.	2. Listen and observe.
3. Trainer supervises the trainees.	3. Trainees practise the procedure.

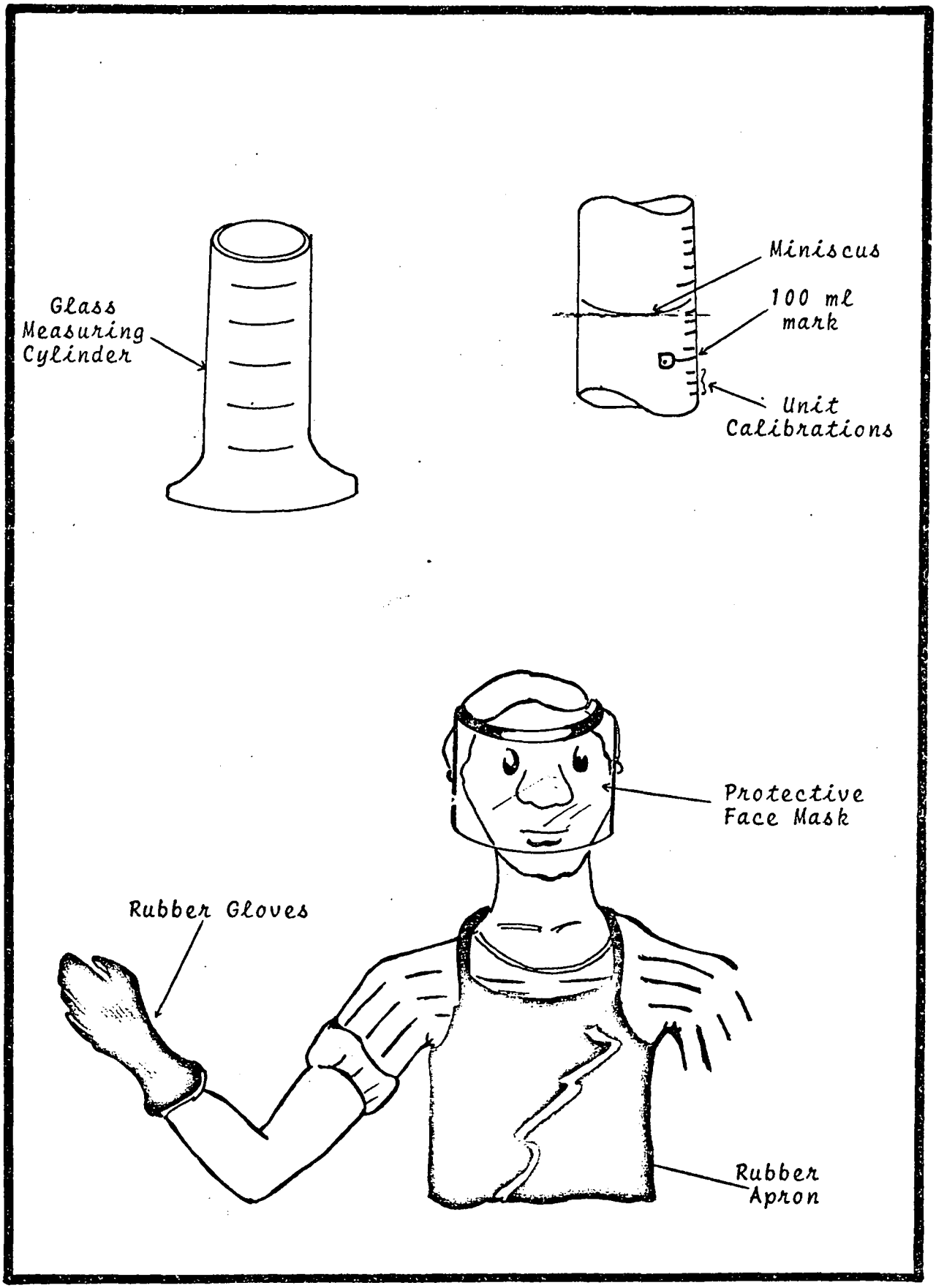
OPERATION BREAKDOWN SHEET

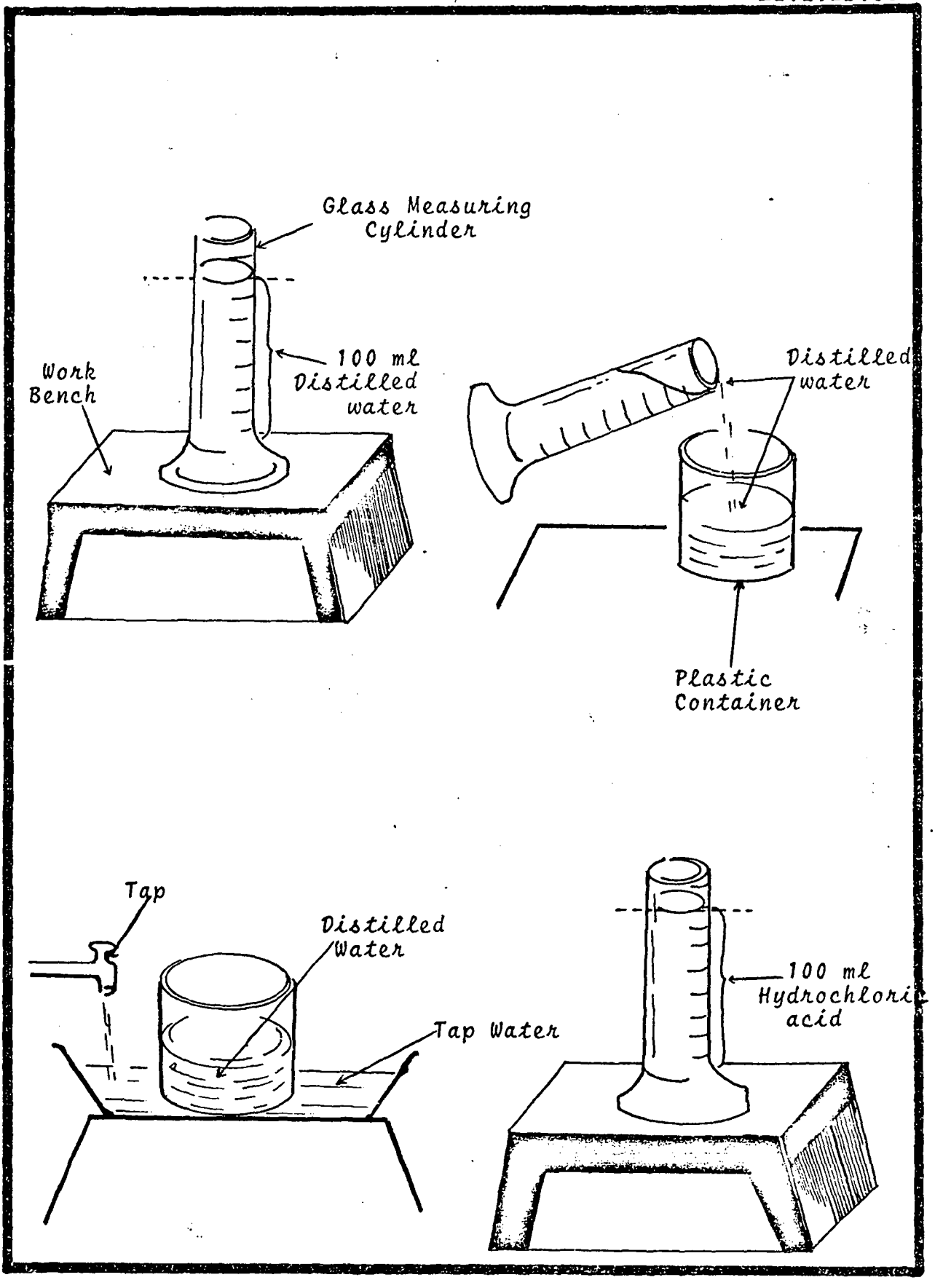
L2.1:IS:01

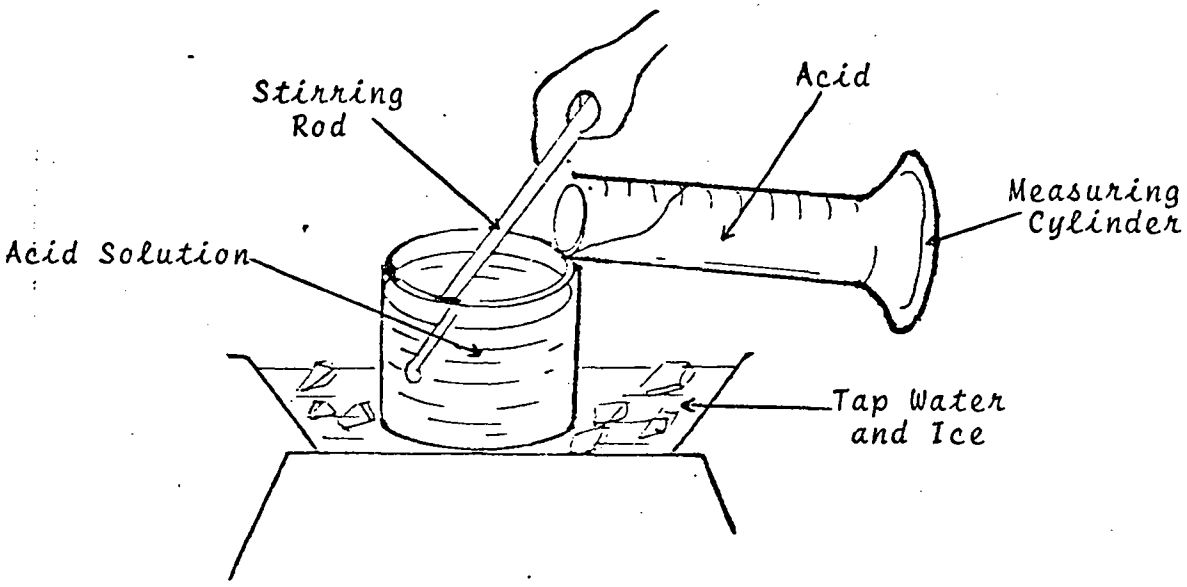
POSITION *Meter Repair Assistant* TASK *Cleaning the meter Components*

OPERATION *Preparing a 1:1 dilute hydrochloric acid solution*

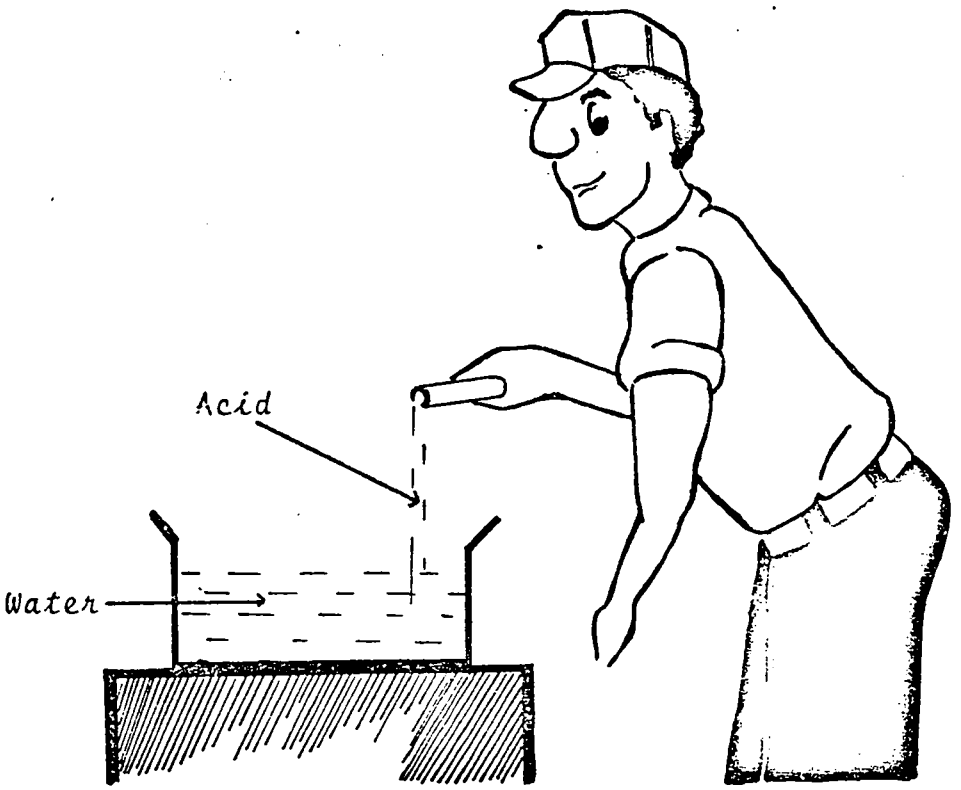
Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
1. *Prepare 1:1 dilute hydrochloric acid solution.*	1.1 *Put on apron, plastic face mask and rubber gloves.* 1.2 *Fill glass graduated measuring cylinder to 100 ml. mark with distill water.* 1.3 *Transfer distilled water to plastic mixing container.* 1.4 *Put adequate quantity of tap water and ice in the sink.* 1.5 *Place mixing container with Distilledwater in the sink.* 1.6 *Measure 100 ml. of hydrochloric acid in the glass cylinder.* 1.7 *Add the hydrochloric acid slowly to the distilled water and stir; continue to stir for a few minutes.* NB NEVER ADD WATER TO ACID ALWAYS ADD ACID TO WATER


Glass
Measuring
Cylinder
Miniscus
100 ml
mark
Unit
Calibrations
Protective
Face Mask
Rubber Gloves
Rubber
Apron

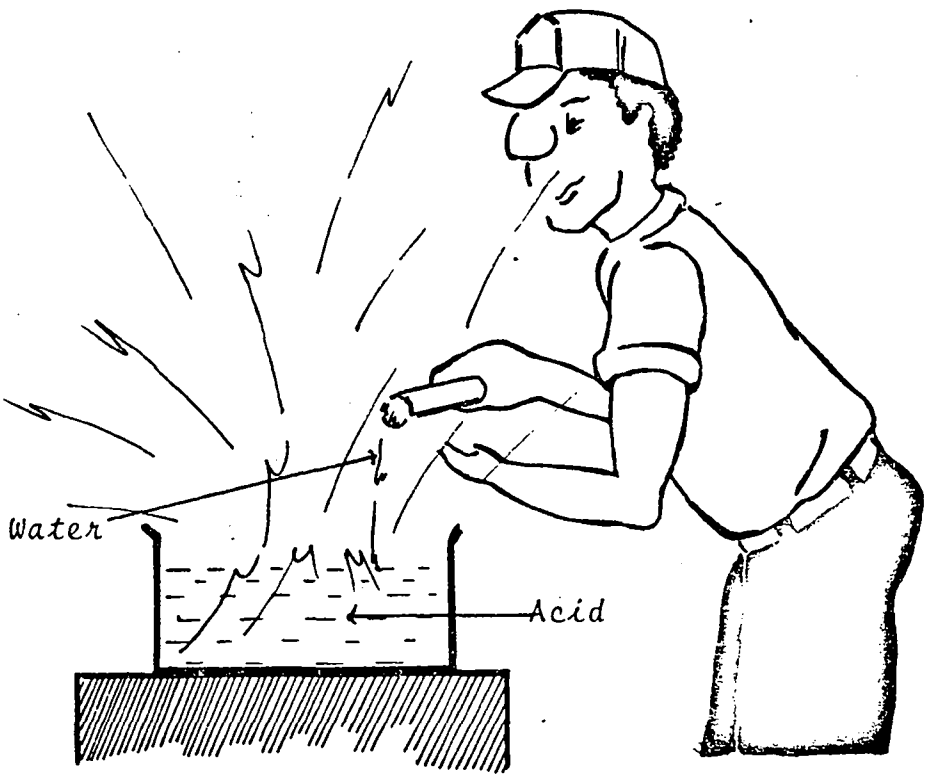

Glass Measuring Cylinder
100 ml Distilled water
Work Bench
Distilled water
Plastic Container
Tap
Distilled Water
Tap Water
100 ml Hydrochloric acid



ADDING ACID TO DISTILLED WATER

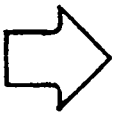


ALWAYS ADD ACID TO WATER



NEVER ADD WATER TO ACID

TRAINING/JOB MANUAL — Maintenance and Testing of Domestic Water Meters

LESSON 2.2  *IMMERSING THE COMPONENTS IN THE ACID SOLUTION; REMOVING AND RINSING THE COMPONENTS*

ESTIMATED TIME — 1 hr

PREREQUISITES — Lesson 2.1

PERFORMANCE OBJECTIVE:

- The trainee will <u>be able to</u>:

  demonstrate and explain the procedure for immersing, removing and rinsing the meter components.

- Under the following <u>condition</u>:

  given the equipment and supplies listed below.

- To this <u>standard</u>:

  as outlined in the procedure.

TRAINING RESOURCES

Equipment and Supplies: 1:1 acid solution, bath, tap with running water, brush, copper wire, meter components.

Information Sheets: L2.2:IS:01, L2.2:IS:02 L2.2:IS:03

TRAINING ACTIVITIES

TRAINER ACTIVITY	TRAINEE ACTIVITY
1. Trainer reads and discuss Operation Breakdown Sheet L2.2:IS:01.	1. Read and discuss.
2. Trainer demonstrates and explains the procedure - refer to L2.2:IS:01 -03.	2. Observe and listen.
3. Trainer supervises the trainees.	3. Trainees practise the procedure.

OPERATION BREAKDOWN SHEET

L2.2:IS:01

POSITION *Meter Repair Assistant* TASK *Cleaning the meter components*

OPERATION *Immersing the components in the acid solution, removing and rinsing the components.*

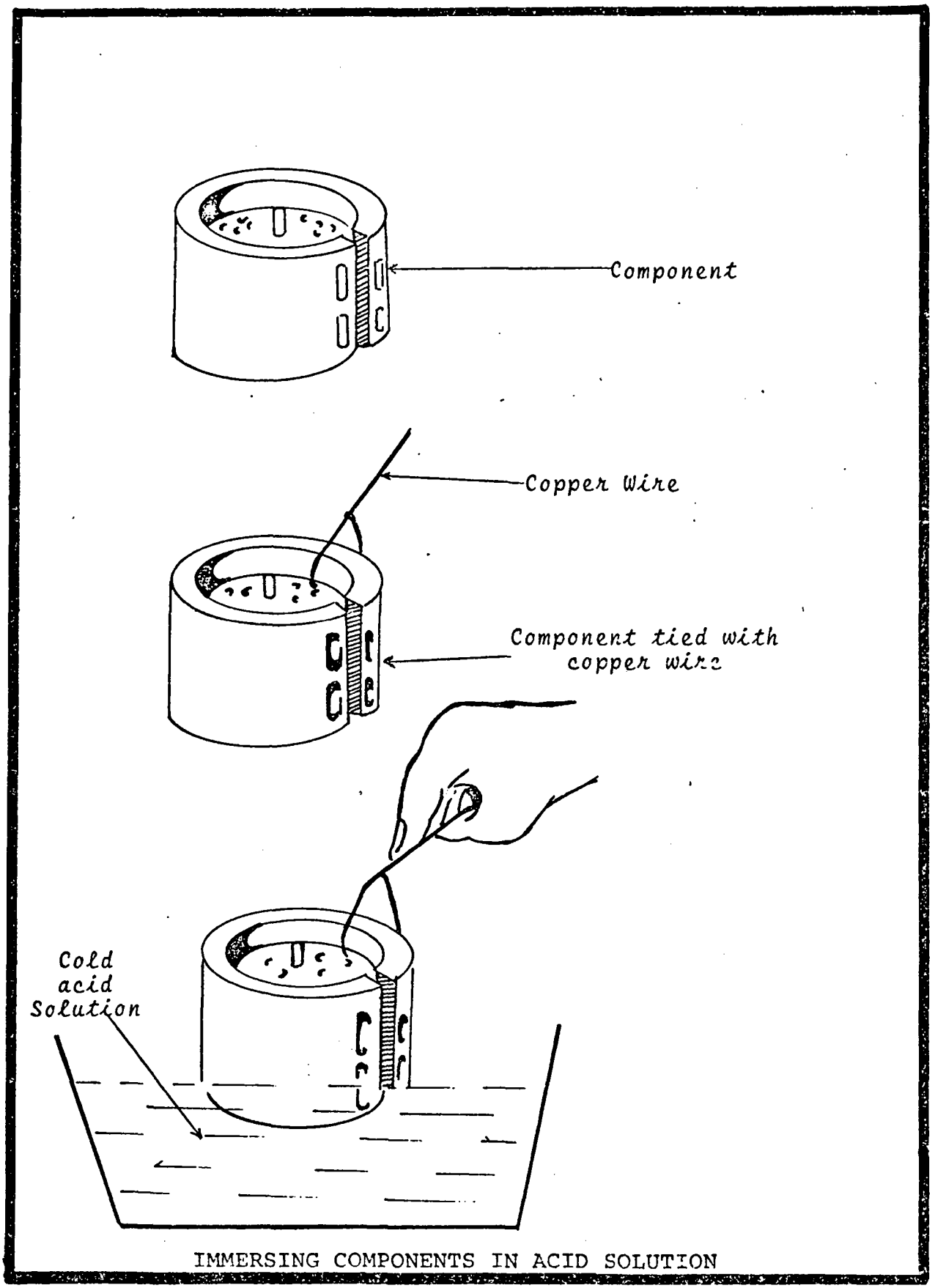
Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
1. *Pour acid solution into bath.*	1.1 *Use a plastic or stone ware bath.* 1.2 *Clean bath before using.* 1.3 *Dry bath before pouring in acid solution.* 1.4 *Pour solution into bath slowly* 1.5 *Stir and allow to cool in an ice bath.*
2. *Immerse components into the bath.*	2.1 *Tie each component with copper wire.* 2.2 *Hold the wire and lower the component slowly into the acid solution.* 2.3 *Each component must be completely immersed.*
3. *Observe the reaction.*	3.1 *Look for effervescence.* 3.2 *Deposits will dissolve.* 3.3 *Immersion period varies from 20 - 30 seconds.*

OPERATION BREAKDOWN SHEET

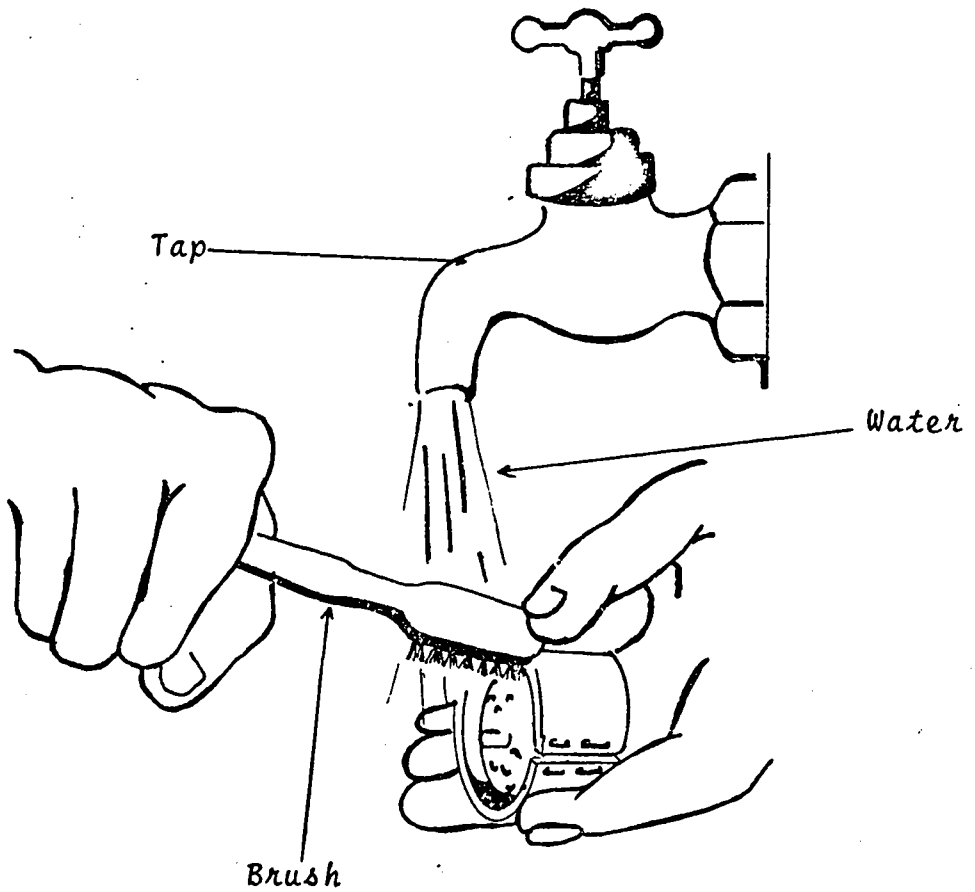
POSITION *Meter REpair Assistant* TASK *Cleaning the meter components*

OPERATION *Immersing components in acid solution, removing and rinsing the components*

Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
4. *Remove the components from the bath.*	4.1 *Lift each component from the bath by holding the copper wire.* 4.2 *Hold near the surface of the solution to drain.* 4.3 *Shake gently but avoid splashing.*
5. *Rinse the components.*	5.1 *Open the tap.* 5.2 *Place the components under the tap.* 5.3 *Use brush to wash each part thoroughly.*



IMMERSING COMPONENTS IN ACID SOLUTION



RINSING COMPONENTS

TRAINING/JOB MANUAL — Maintenance and Testing of Domestic Water Meters

LESSON 3 — *EXAMINING THE METER COMPONENTS FOR WEAR*

ESTIMATED TIME — 1 hr

PREREQUISITES — Lesson 2.3

PERFORMANCE OBJECTIVE:

- The trainee will be able to:

  demonstrate and explain how to check each component of a water meter for wear.

- Under the following condition:

  using the senses of sight and touch to examine the components in a brightly lighted room.

- To this standard:

  all defective parts must be identified.

TRAINING RESOURCES

Supplies and Equipment: New Meter Components, Old Meter Components, Work bench.

Information Sheet: L3:IS:01.

TRAINING ACTIVITIES

TRAINER ACTIVITY	TRAINEE ACTIVITY
1. Place parts for a new meter on the work bench. Place similiar parts for an old meter about 2 cm away.	1. Trainees identify each part and make sure all parts have been displayed.
2. Trainer reads and discusses Operation Breakdown Sheet L3:IS:01.	2. Trainees read and discuss Operation Breakdown Sheet L3:IS:01.
3. Trainer explains and demonstrates the examination of each part, using the new parts as standards.	3. Trainees participate by examining each part acking the trainer his observations.

OPERATION BREAKDOWN SHEET

L3:IS:01

POSITION *Meter Repair Assistant* TASK *Detecting worn components*

OPERATION *Examining the meter components for wear*

Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
1. Check counter assembly.	1.1 Take counter assembly in hand. 1.2 Ensure rubber sac unpunctured. 1.3 Check gearing for excessive wear. 1.4 Rock counter unit for free movement of number wheels.
2. Check Ramp assembly.	2.1 Use hand and examine Ramp assembly. 2.2 Check for free movement of tapered wedge on ramp body. 2.3 Check the spring for damage.
3. Check reduction gear.	3.1 Look for wear on reduction gearing. 3.2 Look for excessive play on the spindles of the gearing. 3.3 Turn number wheels for wheel freedom.
4. Check working chamber top plate.	4.1 Examine the top plate for undue wear. 4.2 Look for scoring of the flat surface. 4.3 Look for side play of the drive spindle.

POSITION Meter Repair Assistant TASK Detecting Worn components

OPERATION Examining the meter components for wear

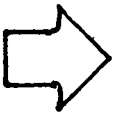
Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
5. Check working chamber.	5.1 Examine chamber walls. 5.2 Examine centre post. 5.3 Use a pair of smooth jawed pliers to remove shutter. 5.4 Examine shutter for wear. 5.5 Make sure the shutter seats properly on the chamber floor.
6. Check Piston assembly.	6.1 Take piston in hand. 6.2 Look for undue wear. 6.3 Remove any small particles of dirt. 6.4 Look for scoring on outside walls of the piston. 6.5 Check moulding centre post for excessive wear. 6.6 Check strainer for dirt or damage by dirt.
7. Check body sealing and counter gasket.	7.1 Look for stretch on body sealing ring. 7.2 Look for wear on body sealing ring. 7.3 Look for any torn sections of the gasket.

POSITION *Meter Repair Assistant* TASK *Detecting worn components*

OPERATION *Examining the meter components for wear*

Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
8. *Check counter and chamber housing.*	8.1 *Ensure that all threads are free from burrs.* 8.2 *Ensure housing face makes contact with body sealing ring.* 8.3 *Inspect non-return valve.* 8.4 *Ensure valve seating in the bottom of chamber.* 8.5 *Make sure housing free from deposits.* 8.6 *Look for wear or scores*

TRAINING/JOB MANUAL — Maintenance and Testing of Domestic Water Meters

LESSON 4.1  *PREPARING THE WORK BENCH AND SECURING THE HOUSING IN THE VICE*

ESTIMATED TIME — 20 minutes

PREREQUISITES — Lesson 3

PERFORMANCE OBJECTIVE:

- The trainee will <u>be able to</u>:

  demonstrate the preparation of a work-bench and secure the housing in the vice.

- Under the following <u>condition</u>:

  given brush, cloth, paper, soap, water, work-bench vice and air source.

- To this <u>standard</u>:

  operations to be carried out in accordance with procedures, work-bench is to be 100% clean.

TRAINING RESOURCES

Equipment and Supplies: Brush, cloth, paper, soap, water, work-bench, vice, air source.

Information Sheets: L4.1:IS:01, L4.1:IS:02.

TRAINING ACTIVITIES

TRAINER ACTIVITY	TRAINEE ACTIVITY
1. Review the procedure outlined in Operation Breakdown sheet L4.1:IS:01.	1. Review the procedure outlined in Operation Breakdown sheet L4.1:IS:01.
2. Trainer explains and demonstrates the procedure L4.1:IS:01 - 02.	2. Trainees listen and observe.
3. Trainer supervises the trainees during the practice of the procedure.	3. Trainees practise the procedure under the supervision of the trainer.

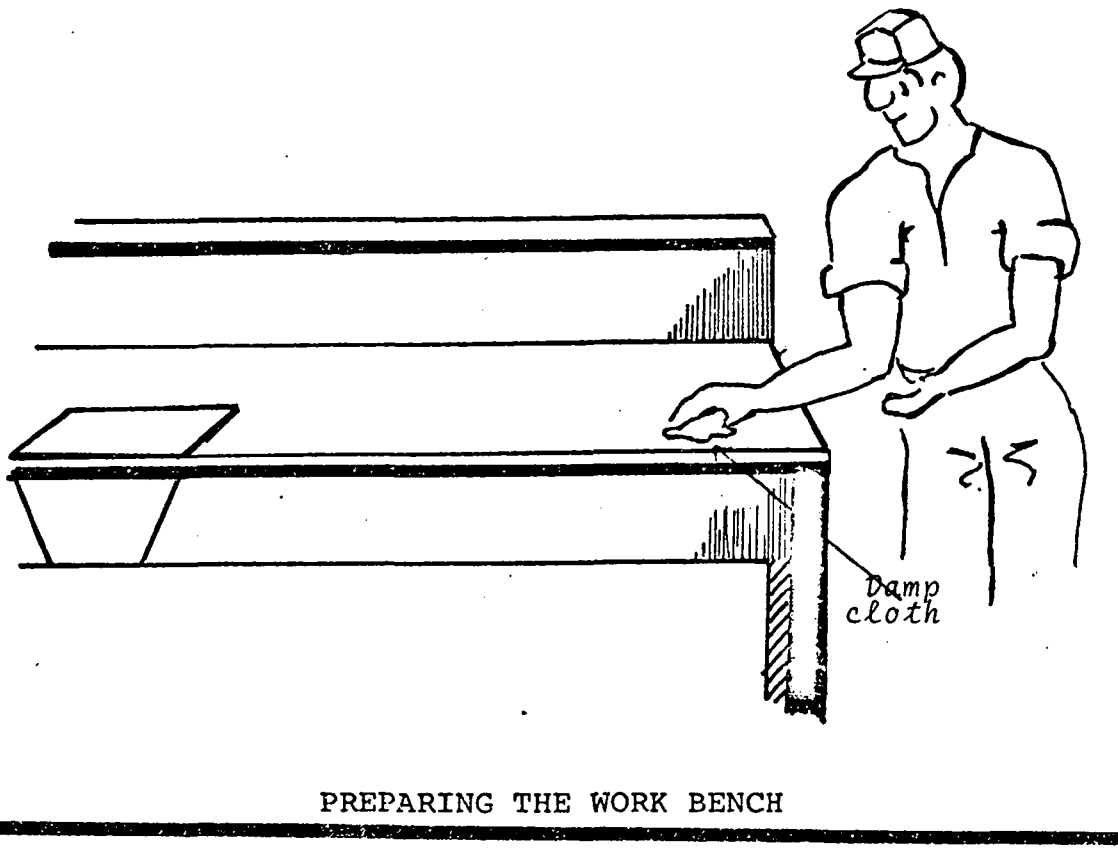
OPERATION BREAKDOWN SHEET

L4.1:IS:01

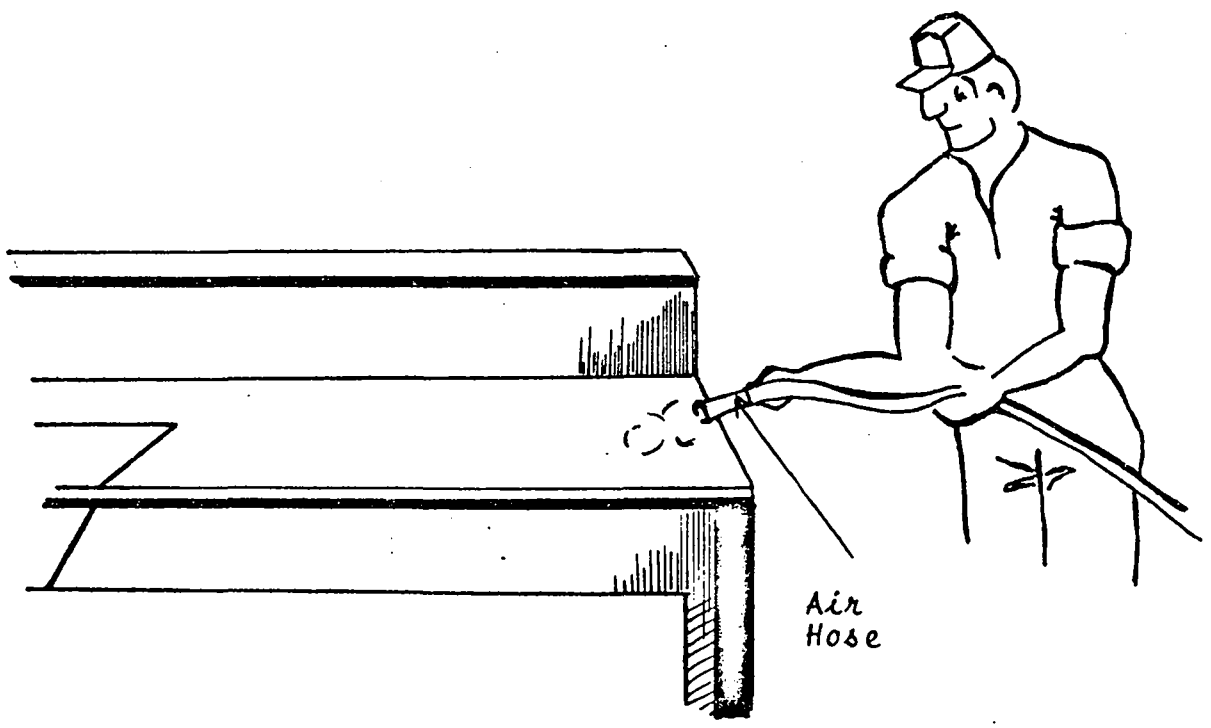
POSITION *Meter Repair Assistant* TASK *Reassembling the meter*

OPERATION *Preparing the work bench and securing the housing in the vice*

Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
1. *Prepare the bench.*	1.1 *Use cloth soaked with soapy water to wipe down work bench.* 1.2 *Use dry cloth to dry the bench.* 1.3 *Use an air source to remove grit - use brush if air source is not available.* 1.4 *Cover the work bench with a clean piece of paper.*
2. *Secures the housing in the vice.*	2.1 *Use the protective guard on vice jaws.* 2.2 *Place the housing flats in vice jaws.* 2.3 *Place the counter window lid to face the left side of the vice.* 2.4 *Avoid over tightening the vice.*

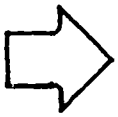


PREPARING THE WORK BENCH



PREPARING THE WORK BENCH

TRAINING/JOB MANUAL — Maintenance and Testing of Domestic Water Meters

LESSON 4.2  *FITTING AND LOCKING THE COUNTER UNIT IN POSITION*

ESTIMATED TIME — 20 minutes

PREREQUISITES — Lesson 3

PERFORMANCE OBJECTIVE:

- The trainee will <u>be able to</u>:

  demonstrate and explain the procedure for fitting and locking the counter unit in position.

- Under the following <u>condition</u>:

  given meter housing, counter unit and gasket.

- To this <u>standard</u>:

  operation is to be carried out according to the procedure.

TRAINING RESOURCES

Equipment and Supplies: Meter housing, Counter unit, Gasket, Grease.

Information Sheets: L4.2:IS:01, L4.2:IS:02.

TRAINING ACTIVITIES

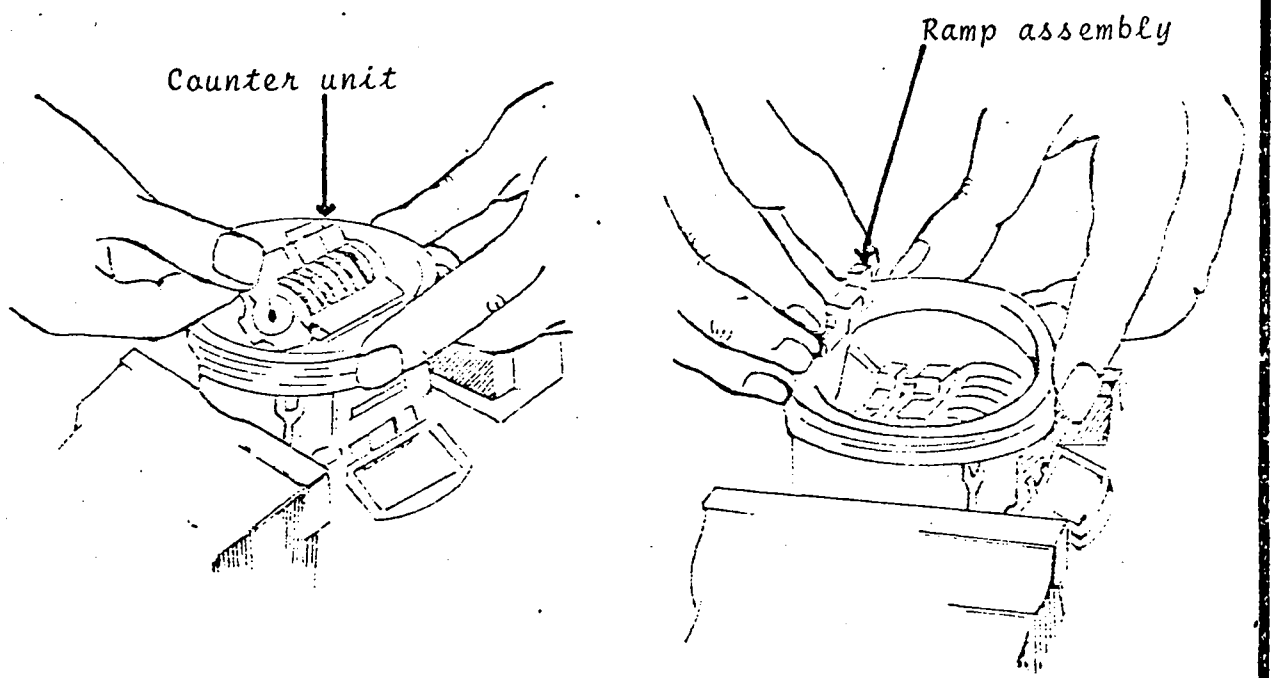
TRAINER ACTIVITY	TRAINEE ACTIVITY
1. Trainer reviews the procedure outlined in Operation Breakdown Sheet L4.2:IS:01.	1. Trainees review the procedure outlined in Operation Breakdown Sheet L4.2:IS:01.
2. Trainer explains and demonstrates the procedure L4.2:IS:01-02.	2. Trainees listen and observe.
3. Trainer supervises trainees during the practice of the procedure.	3. Trainees practise the procedure under the supervision of the trainer.

OPERATION BREAKDOWN SHEET L4.2:IS:01

POSITION Meter Repair Assistant TASK Reassembling the meter

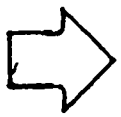
OPERATION Fitting and Locking the counter unit in position

Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
1. Fit counter unit.	1.1 Use hand and smear counter gasket with grease.
	1.2 Use hands and remove excess grease.
	1.3 Hold the counter unit between the right index finger and thumb.
	1.4 Drive coupling should be uppermost.
	1.5 Place it in position with the digits located in the aperture of the counter housing.
	1.6 Hold firmly in position.
2. Lock counter in position.	2.1 Take the ramp assembly between the thumb and forefinger of the right-hand.
	2.2 Use the lugs provided with flat face towards the two webs of the counter housing.
	2.3 Press the lugs together.
	2.4 Place between the base of the counter and the two webs of the counter housing.
	2.5 Centralize the ramp and insert to full depth.



FITTING AND LOCKING COUNTER UNIT IN POSITION

TRAINING/JOB MANUAL — Maintenance and Testing of Domestic Water Meters

LESSON 4.3  *INSERTING THE FLOW STRAINER AND LOCKING WITH THE CIRCLIP*

ESTIMATED TIME — 20 minutes

PREREQUISITES — Lesson 3

PERFORMANCE OBJECTIVE:

- The trainee will <u>be able to</u>:

  demonstrate and explain the insertion of a flow strainer and the locking of it with a circlip.

- Under the following <u>condition</u>:

  given meter housing with counter unit, flow strainer and circlip.

- To this <u>standard</u>:

  the operation is to be carried out in accordance with the procedure outlined.

TRAINING RESOURCES

Equipment and Supplies: Meter Housing with counter unit, flow strainer, circlip.

Information Sheets: L4.3:IS:01, L4.3:IS:02.

TRAINING ACTIVITIES

TRAINER ACTIVITY	TRAINEE ACTIVITY
1. Read and discuss Operation Breakdown Sheet L4.3:OS:O1, with the trainees.	1. Read and discuss with the trainer.
2. Demonstrate and explain the procedure. Refer to L4.3:IS:O1 - O2.	2. Observe the procedure.
3. Supervise the trainees.	3. Practise the procedure.

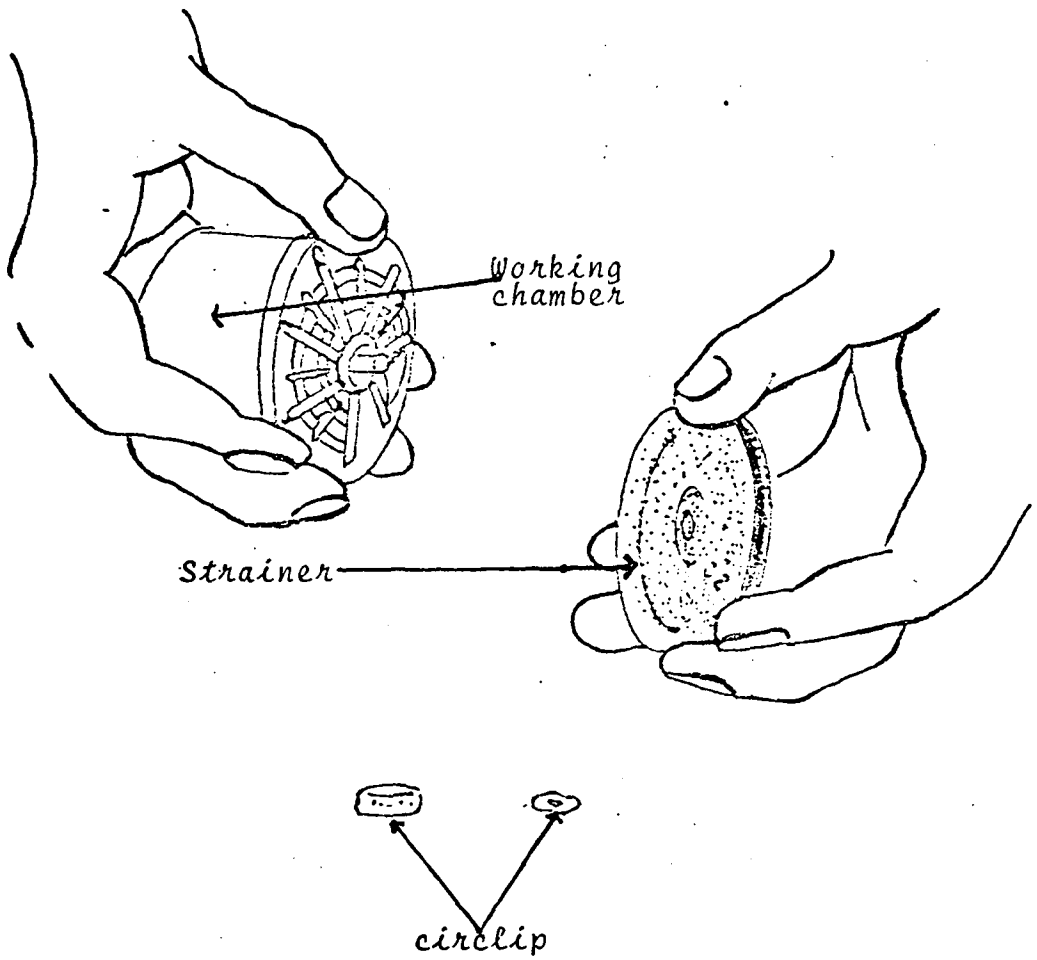
OPERATION BREAKDOWN SHEET

L4.3:IS:01

POSITION *Meter Repair Assistant* TASK *Reassembling the meter*

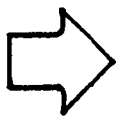
OPERATION *Inserting the flow strainer and locking with the circlip*

Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
1. *Insert flow strainer.*	1.1 *Gently and equally press outwards.* 1.2 *Ensure counter is firmly and squarely pressed against its gasket.* 1.3 *Press counter up forcing ramp forward.* 1.4 *Position strainer over the shaft at the bottom of the working chamber.*
2. *Lock with circlip.*	2.1 *Place circlip on working chamber.* 2.2 *Place circlip sufficiently down the shaft.* 2.3 *Circlip retains strainer.* 2.4 *Strainer is to be free enough to rotate around working chamber.*



REPLACING FLOW STRAINER AND LOCKING WITH CIRCLIP

TRAINING/JOB MANUAL Maintenance and Testing of Domestic Water Meters

LESSON 4.4  *INSERTING THE PISTON AND PLACING TOP PLATE ON THE CHAMBER*

ESTIMATED TIME 20 minutes

PREREQUISITES Lesson 3

PERFORMANCE OBJECTIVE:

- The trainee will <u>be able to</u>:

  demonstrate and explain the insertion of the piston in place and the placing of top plate on the chamber.

- Under the following <u>condition</u>:

  given meter housing and components.

- To this <u>standard</u>:

  operation is to be carried out in accordance with the procedure outlined.

TRAINING RESOURCES

Equipment and Supplies: Meter Housing, components

Information Sheets: L4.4:IS:01, L4.4:IS:02

TRAINING ACTIVITIES

TRAINER ACTIVITY	TRAINEE ACTIVITY
1. Trainer reads and discusses Operation Breakdown Sheet L4.4:IS:01.	1. Read and discuss.
2. Trainer demonstrates and explains the procedure. Refer to L4.4:IS:01 - 02.	2. Trainees observe.
3. Trainer supervises the trainees.	3. Trainees practise the procedure.

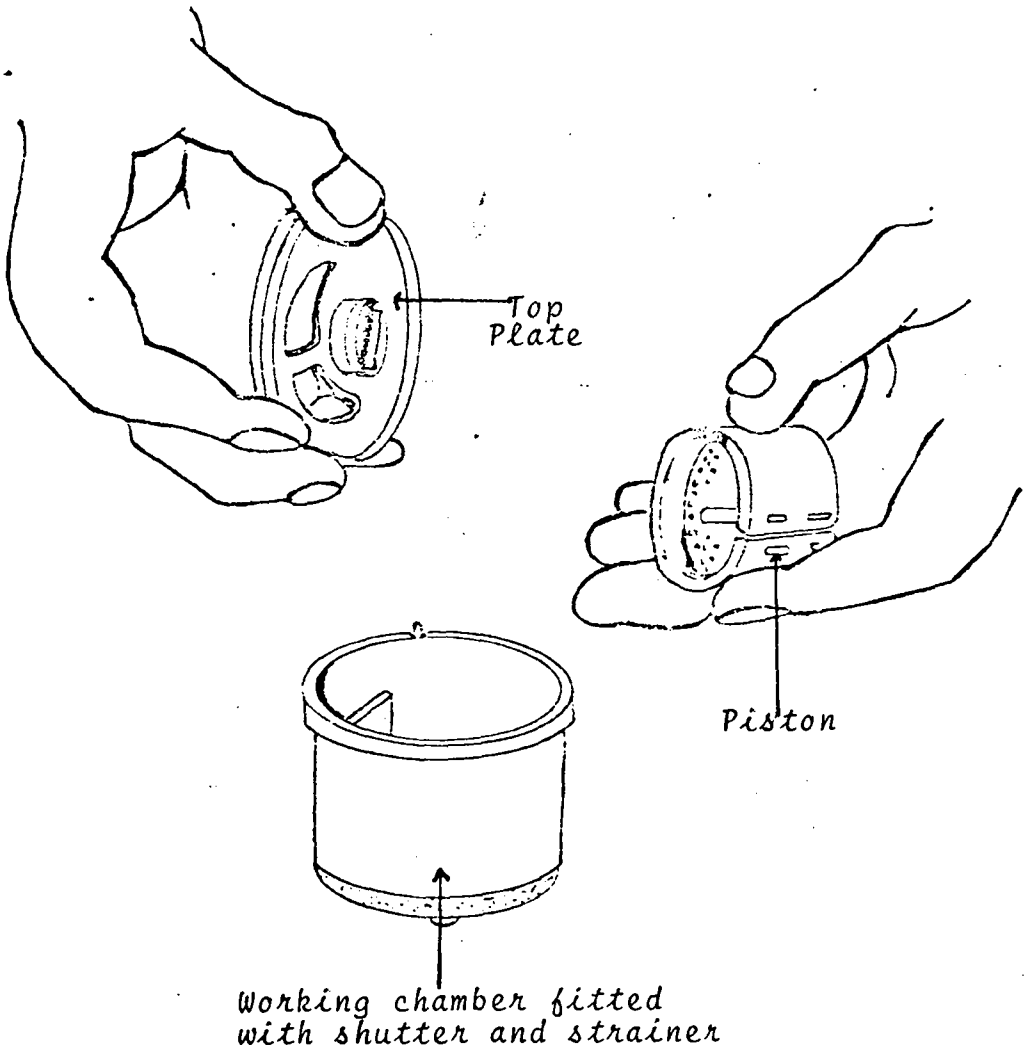
OPERATION BREAKDOWN SHEET

L4.4:IS:01

POSITION *Meter Repair Assistant* TASK *Reassembling the Meter*

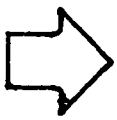
OPERATION *Inserting the piston and replacing the top plate on the Chamber*

Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
1. *Inserts piston in place.*	1.1 *Fit the shutter in working chamber.* 1.2 *Fit the two ridges on the edge in the lower half of chamber wall slot.* 1.3 *Locate correctly in the slot at the bottom.* 1.4 *Check that the moulded peg is facing down.* 1.5 *Check that the piston moves freely around the working chamber.*
2. *Places top plate on chamber.*	2.1 *Ensure that the driving bar engages with the nickel piston peg.* 2.2 *Make sure that the shutter fits into the hub of the top plate.* 2.3 *Press firmly into piston.* 2.4 *Test again for piston freedom.* 2.5 *Hold the chamber on its side and slowly rotate.* 2.6 *Piston should rotate under its own weight.*



INSERTING THE PISTON AND REPLACING THE TOP PLATE WITH CHAMBER

TRAINING/JOB MANUAL — Maintenance and Testing of Domestic Water Meters

LESSON 4.5  *REPLACING WORKING CHAMBER AND SCREWING ON CHAMBER HOUSING*

ESTIMATED TIME — 20 minutes

PREREQUISITES — Lesson 4.4

PERFORMANCE OBJECTIVE:

- The trainee will <u>be able to</u>:

  demonstrate and explain how to place complete working chamber in meter housing.

- Under the following <u>condition</u>:

  given meter housing and components.

- To this <u>standard</u>:

  operation is to be carried out in accordance with the procedure outlined.

TRAINING RESOURCES

Equipment and Supplies:	Meter Housing, components, tools to tighten Meter housing
Information Sheets:	L4.5:IS:01, L4.5:IS:02, L4.5:IS:03.

TRAINING ACTIVITIES

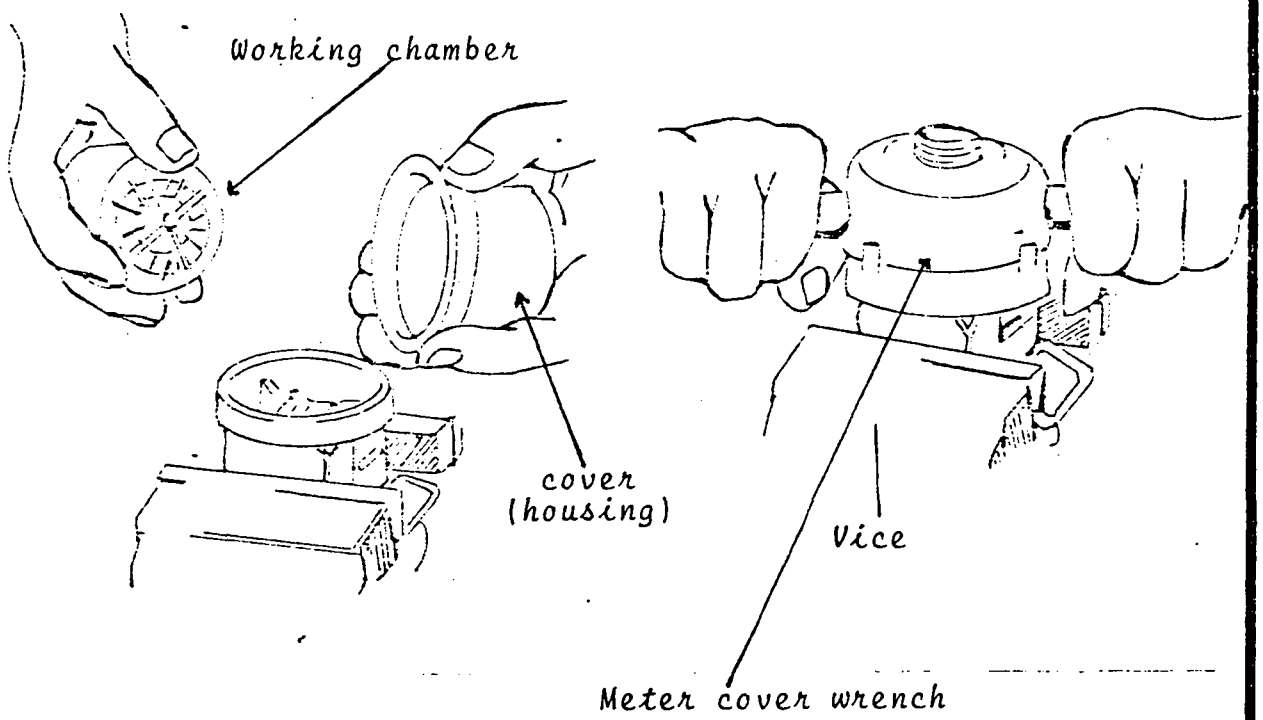
TRAINER ACTIVITY	TRAINEE ACTIVITY
1. Trainer reads and discusses L4:IS:01.	1. Read and discuss.
2. Trainer demonstrates and explains the procedure. Refer to L4.5:IS:01 - 03.	2. Trainees observe and discuss. Refer to L4.5:IS:01 - 03.
3. Trainer supervises the trainees during the practise of the procedure.	3. Trainees practise the procedure.

OPERATION BREAKDOWN SHEET L4.5:IS:01

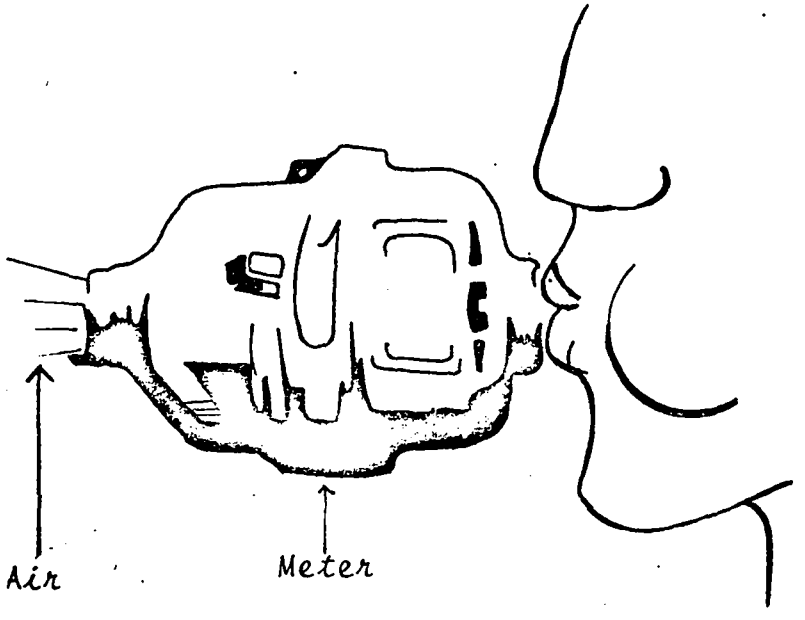
POSITION *Meter Repair Assistant* TASK *Reassembling the Meter*

OPERATION *Replacing the working chamber and screwing on the chamber housing*

Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
1. *Place complete working chamber on housing.*	1.1 *Driving coupling should be engaged with the counter coupling.* 1.2 *Outlet port in the top plate should be placed over the counter ramp.*
2. *Screw on chamber housing housing.*	2.1 *Lightly grease the body sealing ring.* 2.2 *Place it over the working chamber.* 2.3 *Use tool to tighten.* 2.4 *Tighten the joint securely without using excessive force.*
3. *Check the meter.*	3.1 *Place lip on the end with check valve.* 3.2 *Blow through the meter.* 3.3 *Listen for clicking noise.*

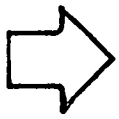


REPLACING WORKING CHAMBER AND SCREWING ON CHAMBER HOUSING



BLOWING THROUGH THE METER

TRAINING/JOB MANUAL — Maintenance and Testing of Domestic Water Meters

LESSON 5.1  *CHECKING TEST APPARATUS AND ATTACHING WATER METERS*

ESTIMATED TIME — 40 minutes

PREREQUISITES — Lesson 4.5

PERFORMANCE OBJECTIVE:

- The trainee will <u>be able to</u>:

  check the test apparatus and attach the water meters.

- Under the following <u>condition</u>:

  given the equipment and supplies listed below.

- To this <u>standard</u>:

  apparatus and meter connections must be 100% leak free.

TRAINING RESOURCES

Equipment and Supplies:	Test bench, calibrated tank, water source, water meters, tool kit.
Information Sheets:	L5.1:IS:01, L5.1:IS:02, L5.1:IS:03.

TRAINING ACTIVITIES

TRAINER ACTIVITY	TRAINEE ACTIVITY
1. Trainer introduces the trainee to the test apparatus - Refer to L5.1:IS:02.	1. Trainees observe and make an effort to recall the names of the various parts Refer to L5.1:IS:02.
2. Trainer, with the aid of L5.1:IS:01-03, explains and demonstrates the procedure for checking the apparatus and attaching the meters.	2. Trainees observe and participate. Refer to L5.1:IS:01 -03.
3. Trainer supervises the trainees in the practice of the procedure.	3. Trainees practise the procedure under the guidance of the trainer.

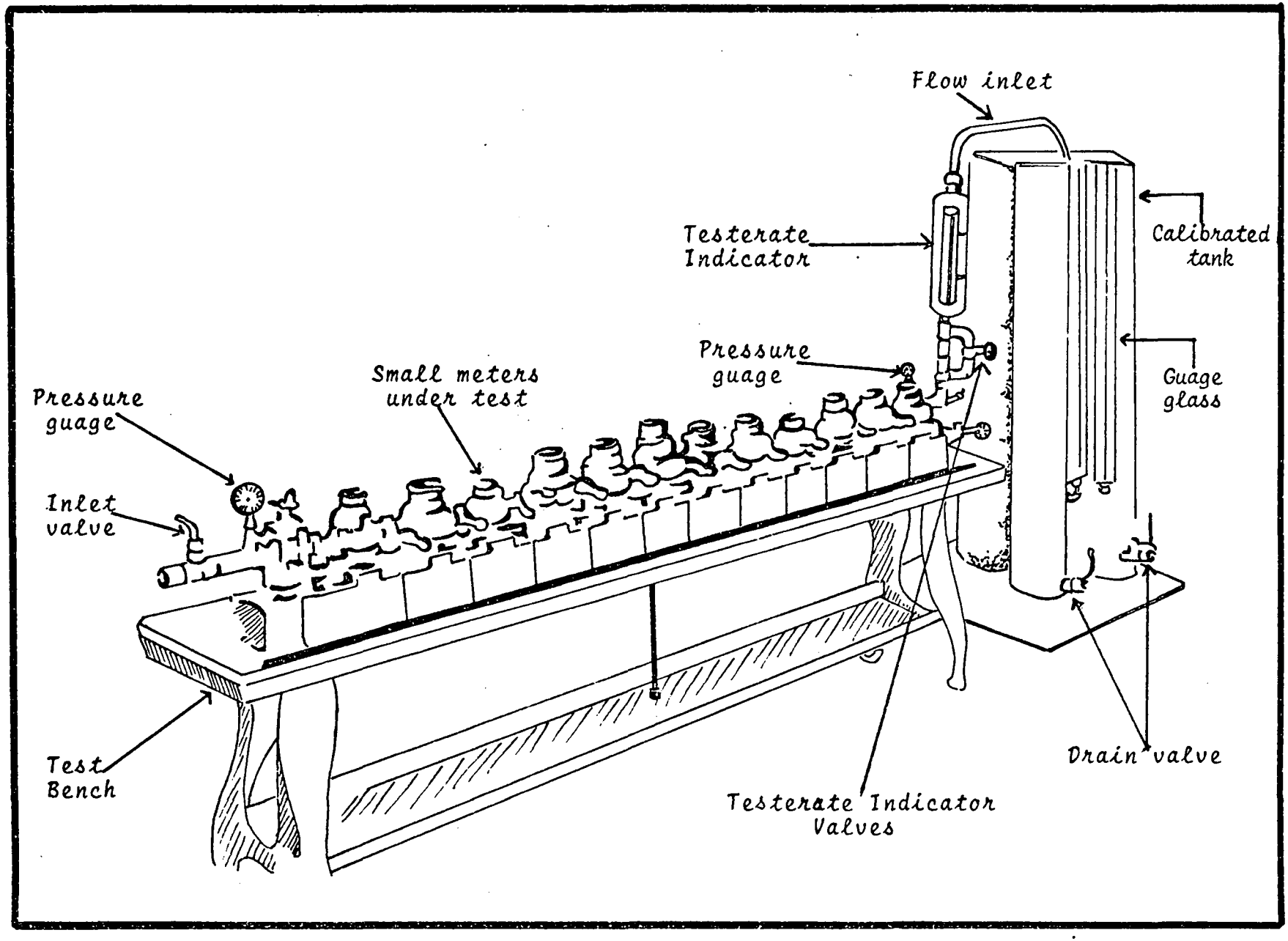
OPERATION BREAKDOWN SHEET

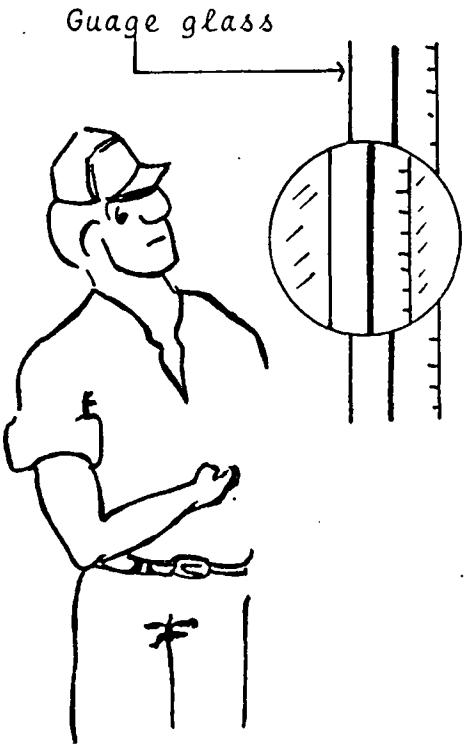
L5.1:IS:01

POSITION *Meter Repair Assistant* TASK

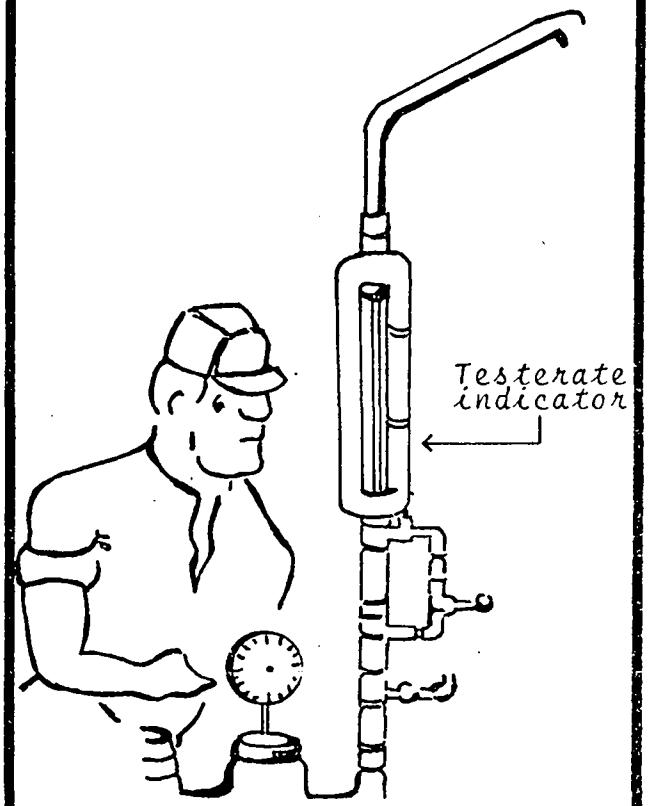
OPERATION *Checking test apparatus and attaching meters*

Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
1. *Check testing apparatus.*	1.1 *Half (½) fill the tank with water.* 1.2 *Look for leaks especially around guage glass joints.* 1.3 *Turn drain valve anticlockwise to let water out of tank.* 1.4 *Close down valve (clockwise) after draining tank.* 1.5 *Turn (anticlockwise) valves on testerate indicator to open.* 1.6 *Look for any cracks on the tapered calibrated tube.* 1.7 *Ensure that the indicator in calibrated tube can move freely.* 1.8 *See that the pressure guages are at the zero mark.*
2. *Attach meters to testing apparatus.*	2.1 *Use hands and screw on meters to be tested.* 2.2 *Use adjustable wrench and tighten connection between meters.* 2.3 *Use no excess pressure to tighten connections.*

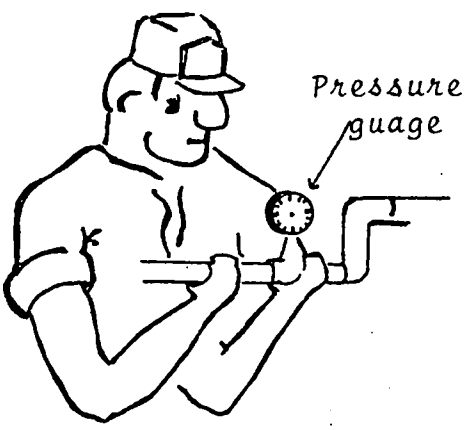

Flow inlet
Testerate Indicator
Calibrated tank
Pressure guage
Small meters under test
Pressure guage
Guage glass
Inlet valve
Test Bench
Testerate Indicator Valves
Drain valve



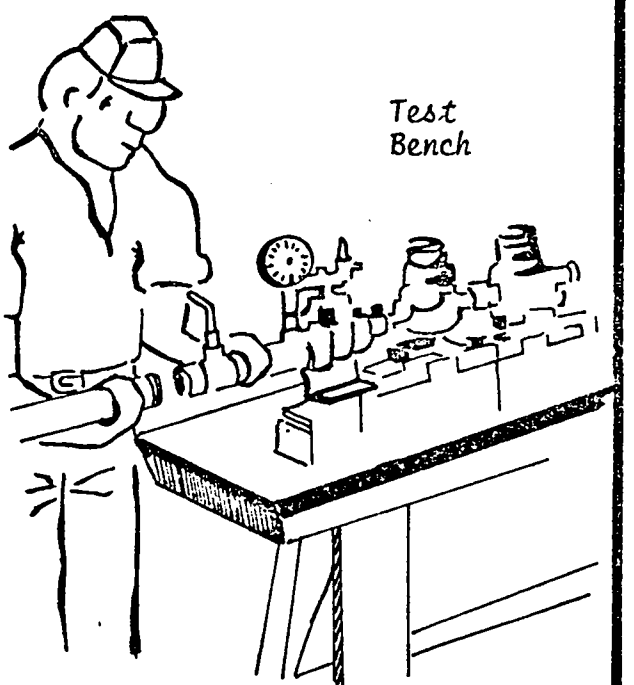
CHECKING GUAGE GLASS FOR LEAKS



INSPECTING EQUIPMENT

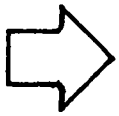


CHECKING PRESSURE GUAGE



CONNECTING WATER SOURCE AND TIGHTENING METER

TRAINING/JOB MANUAL — Maintenance and Testing of Domestic Water Meters

LESSON 5.2  *APPLYING FLOW PRESSURE AND ADJUSTING AND RECORDING FLOW RATES*

ESTIMATED TIME — 40 minutes

PREREQUISITES — Lesson 5.1

PERFORMANCE OBJECTIVE:

- The trainee will be able to:

  demonstrate and explain the procedure for applying flow pressure and adjusting and recording flow rates.

- Under the following condition:

  given the equipment and supplies listed below.

- To this standard:

  there must be no leak and reading must be 100% accurate.

TRAINING RESOURCES

Equipment and Supplies: Test bench, calibrated tank, note book, pencil, water meters, tool kit, water source, chalk board.

Information Sheets: L5.2:IS:01, L5.2:IS:02.

TRAINING ACTIVITIES

TRAINER ACTIVTTY	TRAINEE ACTIVITY
1. Read and explain the procedure outlined in L5.2:IS:01.	1. Read and discuss with the trainer.
2. Use chalk-board illustrations to explain the calibrations on the calibrated tank and pressure guage.	2. Take notes and discuss with trainer.
3. Demonstrate and explain the procedure outlined in L5.2:IS:01. Make a record of the meter reading on the chalk board.	3. Observe, participate and discuss with the trainer.
4. Encourage the trainees to practise the procedure.	4. Practise the procedure under the supervision of the trainer.

OPERATION BREAKDOWN SHEET

L5.2:IS:01

POSITION Meter Repair Assistant TASK Testing a Water Meter

OPERATION Applying flow pressure and adjusting and recording flow rates.

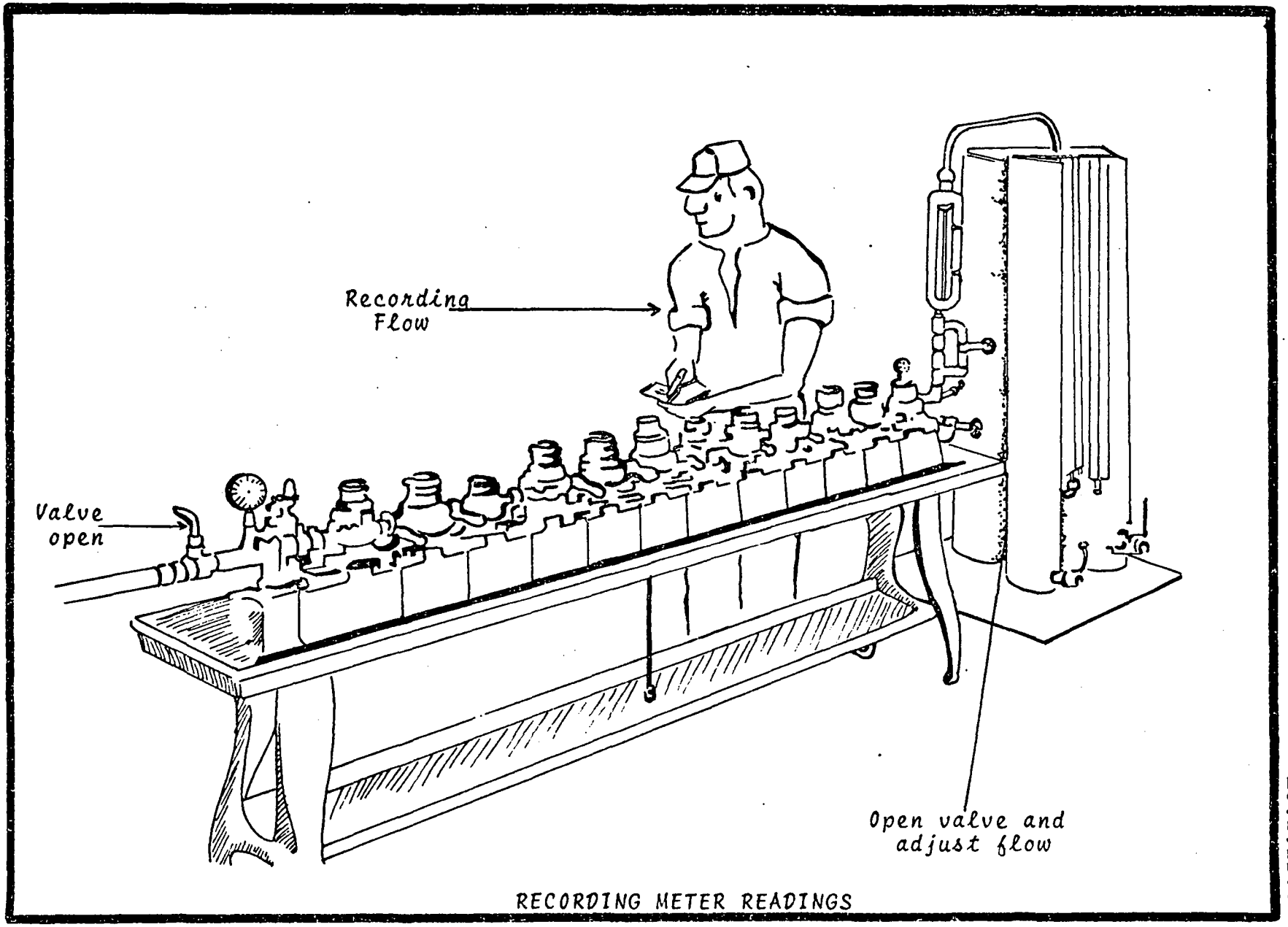
Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
1. Apply Flow Pressure.	1.1 Turn on water. 1.2 Open all valves. 1.3 Allow water to pass through system. 1.4 Allow 5 gallons to pass to eliminate all air. 1.5 Note pressure on guages between 0 - 300 PSI. 1.6 Turn off water. 1.7 Note readings on each meter. 1.8 Open valve on calibrated tank. 1.9 Drain tank to zero.
2. Adjust and record flow rates.	2.1 Note the numerical units on the calibrated tank. 2.2 Open inlet valve. 2.3 Look for water level on guage glass. 2.4 Set valve to record minimum flow. 2.5 Allow water to rise 50% of the volume of the tank.

OPERATION BREAKDOWN SHEET

POSITION *Meter Repair Assistant* TASK *Testing a Water Meter*

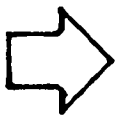
OPERATION *Applying flow pressure and adjusting and recording flow rates*

Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
2. *Adjust and record flow rates.*	2.6 *Note readings on meter.* 2.7 *Open inlet valve to maximum flow.* 2.8 *Record flow when tank is completely filled.*



RECORDING METER READINGS

TRAINING/JOB MANUAL — Maintenance and Testing of Domestic Water Meters

LESSON 5.3  *CALCULATING THE PERCENTAGE ERROR OF THE WATER METER*

ESTIMATED TIME — 45 minutes

PREREQUISITES — Ability to perform basic arithmetic operations

PERFORMANCE OBJECTIVE:

- The trainee will be able to:

  calculate the percentage error on the water meter.

- Under the following condition:

  given the quantity of water passed and the quantity registered.

- To this standard:

  all calculations correct to the nearest whole number.

TRAINING RESOURCES

Equipment and Supplies: Chalk-board, note book, pencil.

Information Sheets: L5.3:IS:01, L5.3:IS:02, L5.3:IS:03.

TRAINING ACTIVITIES

TRAINER ACTIVITY	TRAINEE ACTIVITY
1. Trainer explains the claculations of the percentage error on the chalk board - refer to L5.3:IS:01 - 02.	1. Trainees discuss and make notes.
2. Trainer supervises the trainees during the calculation of percentage errors - L5.3:WS:01.	2. Trainees calculate percentage errors assisted by the trainer if necessary. L5.3:WS:01.
3. Trainer discusses L5.3:IS:03,	3. Trainees discuss with trainer.

OPERATION BREAKDOWN SHEET L5.3:IS:01

POSITION *Meter Repair Assistant* TASK *Testing a Water Meter*

OPERATION *Calculating the percentage error*

Important STEPS in the operation. STEP: A significant action which advances the operation towards completion	KEY POINTS: The key to doing the steps correctly, efficiently and accurately.
HOW HE DOES IT (STEP)	POINTERS TO BE OBSERVED IN PERFORMING THE STEP
1. *Calculate the percentage error.*	1.1 *Review the recorded data.* 1.2 *Find the difference between the Quantity passed and the Quantity registered.* 1.3 *Divide the difference by the Quantity passed and multiply by 100.*

NB % Error = + $\frac{\text{Quantity passed - Quantity registered}}{\text{Quantity passed}} \times 100$

When the quantity registered is greater than the quantity passed the % error will be (-) negative.

METER ≠ No.	QUANTITY PASSED	QUANTITY REGISTERED	PERCENTAGE ERROR
0901	100 gal	98 gal	?
0479	100 gal	94 gal	?
1652	100 gal	101 gal	?
0056	100 gal	106 gal	?

$$\% \text{ ERROR} = \pm \frac{\text{QUANTITY PASSED} - \text{QUANTITY REGISTERED}}{\text{QUANTITY PASSED}} \times 100$$

$$\% \text{ Error} = \frac{100 \text{ Gal} - 98 \text{ Gal}}{100 \text{ Gal}} \times 100$$

$$\% \text{ Error} = \frac{2 \text{ Gals}}{100 \text{ Gals}} \times 100$$

Percentage Error = 2%

Answers

Meter No. 0479 = 6%
" " 1652 = 1%
" " 0056 = 6%

QUANTITY PASSED			
100 gals		100 gals	
QUANTITY REGISTERED			
ACCEPTED READING		UNACCEPTED READING	
FROM	TO	LESS THAN	MORE THAN
98 Gals	102 Gals	98 Gals	102 Gals

For 1000 Gallons multiply by 10

QUESTION PAPER

Instructions: Underline the correct answer in brackets for questions 1 - 18

Lesson 1

1. Protective guard should not be used on bench vice.(True/False)

2. To unscrew meter housing turn clockwise. (True/False)

3. A hammer is used to lift out working chamber. (True/False)

4. Lift out the piston before the strainer is removed. (True/False)

5. There are (18) eighteen external and internal parts of the Domestic Water Meter. (True/False)

LESSON 2

6. Concentrated Hydrocholiric acid is not harmful to the body. (True/False)

7. 1:1 Acid is made by adding equal volumes of acid and rain water. (True/False)

8. Water is always added to acid. (True/False)

9. Heat is generated by acid on contact with water. (True/False)

10. Use your hand and place components into the cleaning solution. (True/False)

LESSON 3

11. Surface of the ramp assembly is to be examined for flatness or score. (True/False)

12. Reduction gear rubber sac should be deflated. (True/False)

13. Remove the top plate of the working chamber assembly inserting a screw driver into slots. (True/False)

14. The piston plays an important part in the accuracy of a water meter. (True/False)

15. The only part of the meter not subject to frictional wear is the piston. (True/False)

16. The domestic water meter in service should be checked thoroughly every three (3) years. (True/False)

QUESTION PAPER (cont'd)

LESSON 4

17. Grease is used lightly on some parts of the meter when re-assembling. (True/False)

18. Piston should move freely around working chamber. (True/False)

19. In Annex 2 each picture is numbered. If the positions of the pictures do not correspond with the steps in re-assembling the water meter, correct it by filling the correct number in the spaces below.

e.g:	6	1	4	3	5	2
Answer						

LESSON 5

20. Formula : Percentage error = $\frac{\text{Quantity passed - Quantity registered}}{\text{Quantity passed}} \times 100$

What is the percentage error?

Quantity passed 1000 Gals.

Quantity registered 999 Gals.

Answers to Question Paper - 1 Annex(1)

Lesson 1

1 False
2 False
3 False
4 True
5 False

Lesson 2

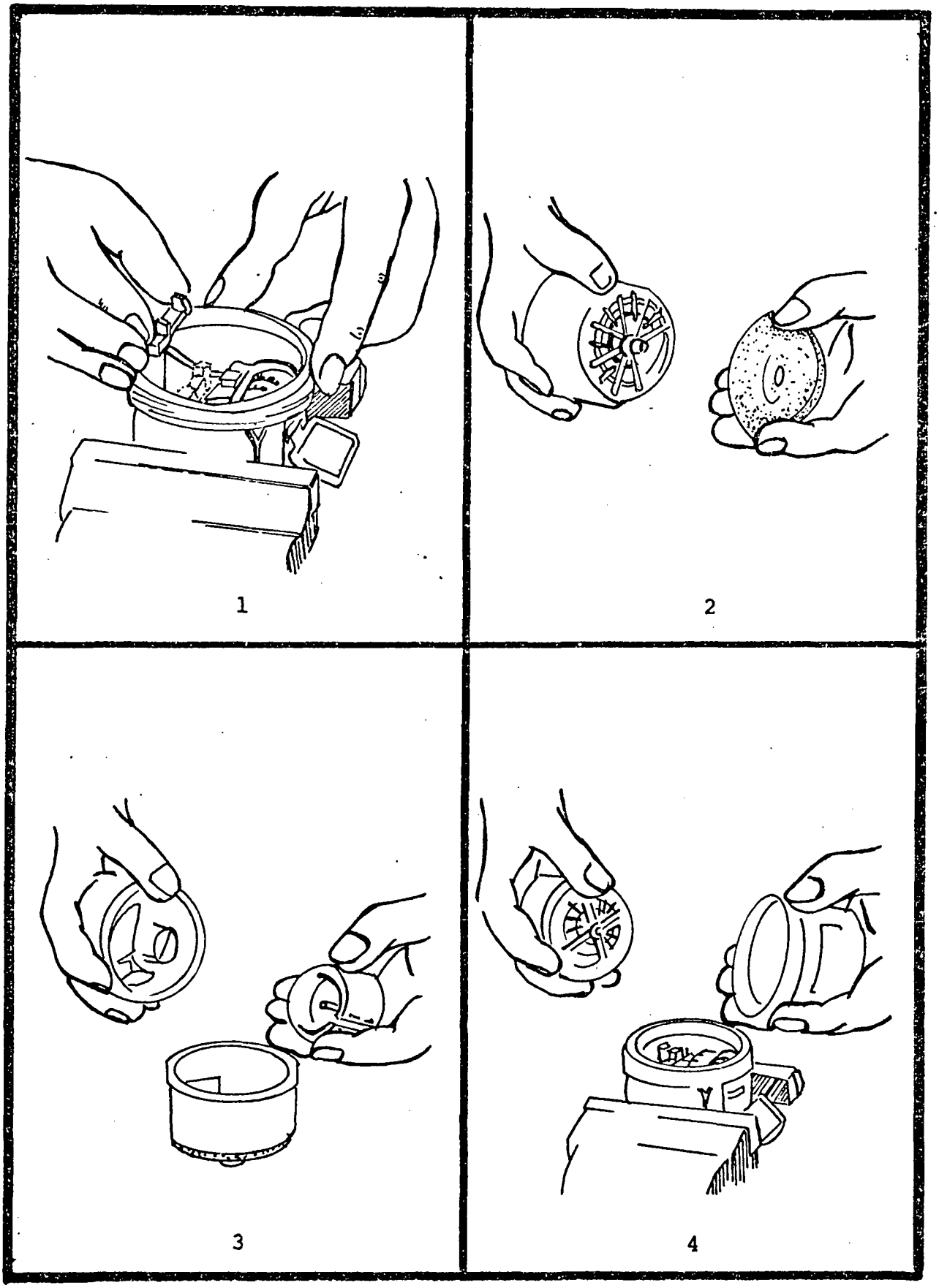
6 True
7 False
8 False
9 True
10 False

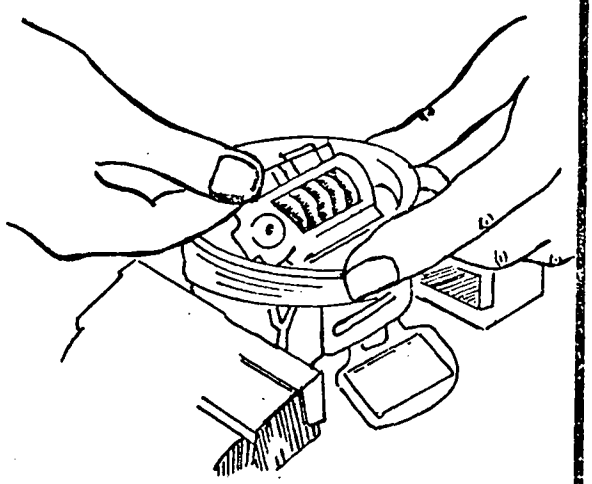
Lesson 3

11 True
12 False
13 True
14 True
15 False
16 True

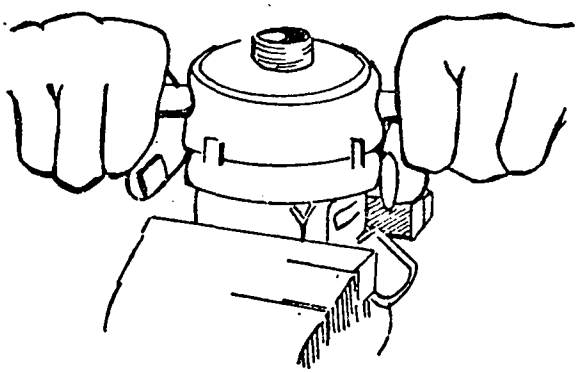
Lesson 4

17 True
18 True
19 5, 1, 2, 3, 4 & 6
20 0.1%


1
2
3
4



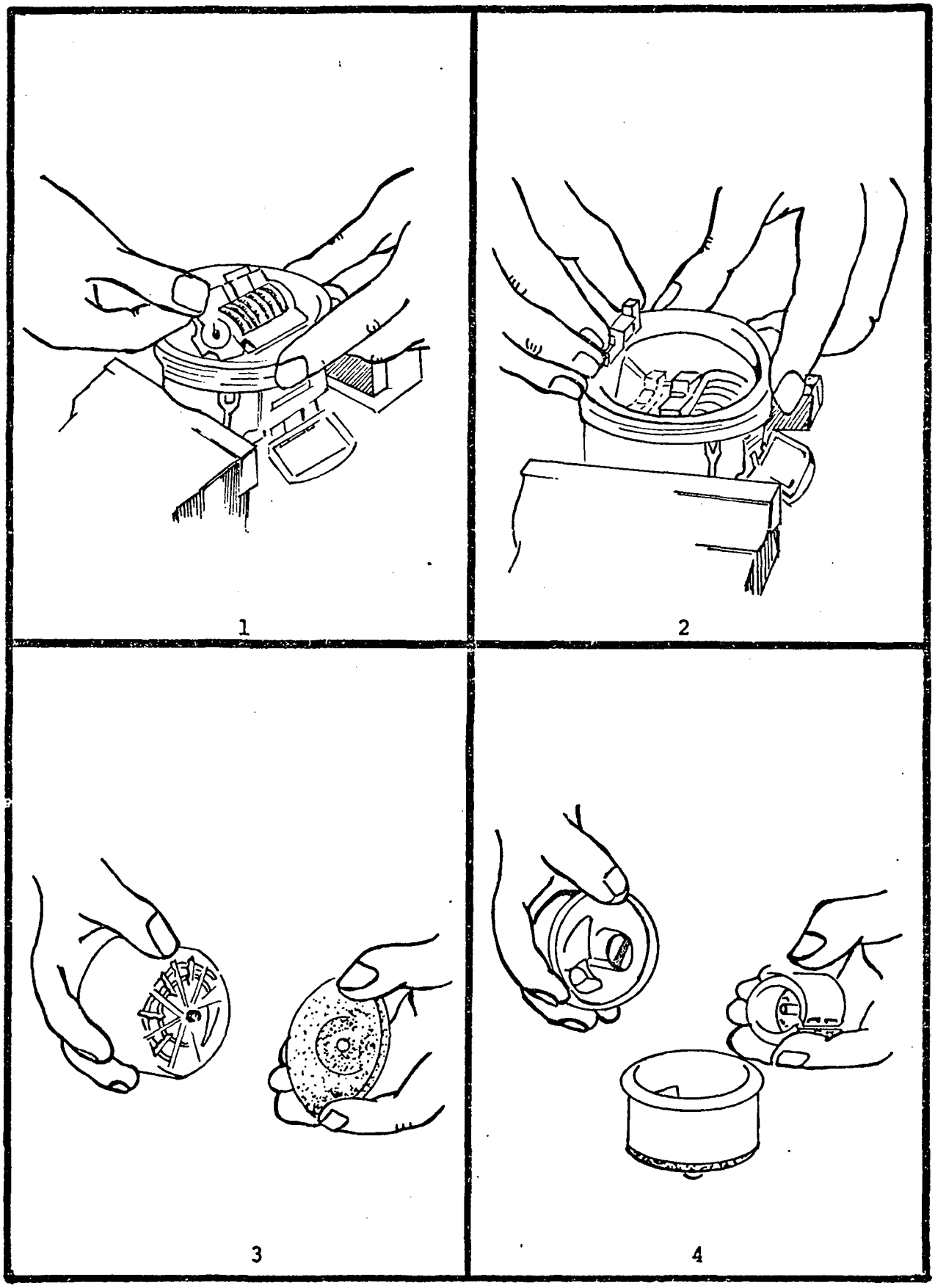
5

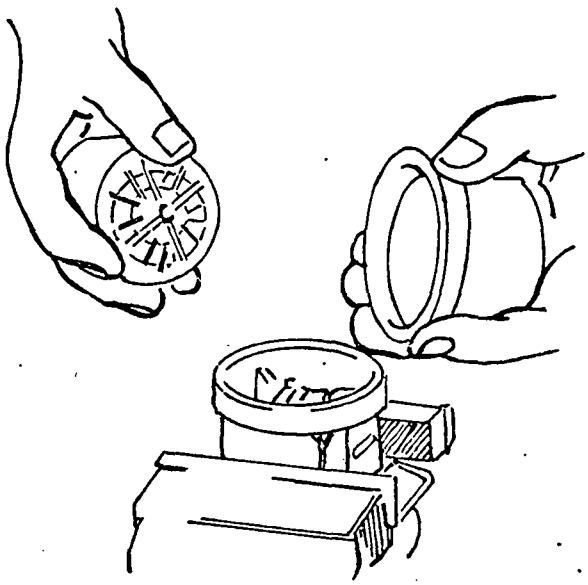


6

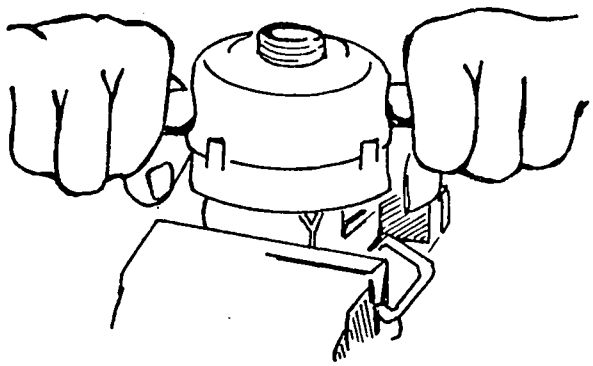
Each picture is numbered. If the sequence does not correspond to that for re-assembling the water meter write the correct sequence of numbers below.

____, ____, ____, ____, ____, ____,


1
2
3
4



5



6

SEQUENCE OF OPERATIONS FOR REASSEMBLING
A METER

FORMULAE FOR CALCULATING VOLUME

Cylindrical Tanks

Formula : Volume = π x Radius^2 x Height

V = $\pi r^2 h$

π = 3.142

r = Radius

h = Height

Rectangular Tanks

Formula: volume = Length x Width x Height

V = LWH

L - Length

W - Width

H - Height

Equivalents

Imperial - Metric

1 in = 2.54 cm = 2.54×10^{2} m

1 ft = 30.5 cm = 0.305 m

1 qt = 946 ml = 0.946 litre

1 gal = 4 qts = 8 pt = 231 in^3 = 3785.43 cm^3

1 ft^2 = 144 in^2 = 928.99 cm^3

Metric - Imperial

1 cm = 0.3937 in = 3.281×10^{-2} ft

1 m = 39.37 in = 3.218 ft = 1.094 yds

1 cm^3 = 0.0610 in^3 = 3.53×10^{-5} ft^3

1 litre = 1.06 qt = 3.53×10^{-2} ft^3

CONVERSION FACTORS

Given cubic feet(ft^3)

Multiply by:

x 28,320 = cubic centi meters - cm^3
x 1,728 = cubic inches - in^3
x 0.2832 = cubic meters m^3
x 7.481 = US Gallons
x 6.229 = IMP gallons

Given cubic inches(in^3)

Multiply by:

x 16.39 = cubic centi meters - cm^3
x 0.0005787 = cubic feet - ft^3
x 0.004329 = U.S gallons
x 0.00365 = IMP gallons
x 0.01639 = litres

given cubic meters - m^3

Multiply by:

x 35.31 = cubic feet - ft^3
x 61023 = cubic inches - in^3
x 264.2 = U.S gallons
x 219.9 = IMP gallons

Given U.S gallons

Multiply by:

x	8.337	= Pounds of water @ $60^{O}F$	
x	3285	= cubic centimeters	- cm^3
x	0.13368	= cubic feet	- ft^3
x	231	= cubic inches	- in^3
x	.003785	= cubic meters	- m^3
x	.83268	= IMP gallons	

Given IMP gallons

Multiply by:

x	10	= Pounds of water @ $60^{O}F$	
x	0.16054	= cubic feet	ft^3
x	0.004546	= cubic meters	m^3
x	1.20094	= U.S gallons	