

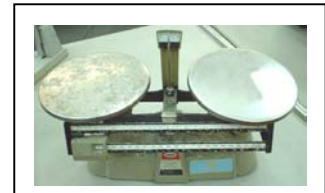
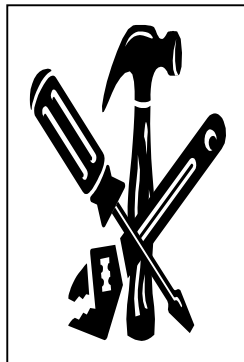


Department of Education



**National Science Teaching
Instrumentation Center**

SCIENCE EQUIPMENT REPAIR AND MAINTENANCE MANUAL



FOREWORD

The DepEd-National Science Teaching Instrumentation Center (NSTIC), through Executive Order 112, is mandated to develop and establish a system of repair and maintenance of science equipment nationwide in response to the dire need of the schools. The present situation showed that the entire country is deficient in the necessary maintenance and repair structures, facilities, technical skills and expertise of personnel.

From 1998 up to the present, NSTIC has been continually sending inspection teams to the various secondary schools in the country to conduct monitoring on the utilization and physical conditions of the NSTIC-distributed science equipment and to perform repair and maintenance of various defective science equipment.

It was noted during these inspections that most of the schools had defective science equipment which were left unattended since nobody is knowledgeable to fix the same.

Due to this appalling situation, NSTIC embarked on the enormous and challenging task of conveying the knowledge and skills of repair and maintenance to the science teachers as well as to the other related personnel in the schools.

This manual was designed to assist science teachers in learning the basics of repair and maintenance. Copies of this manual were provided to teachers during the National and Division Level trainings conducted by NSTIC.

So far, this manual has been very effective since it has opened the teachers' awareness that repair and maintenance is not so difficult. In fact, when given the right tools and instruction, it could be very easy.

Starting CY 2003, one of the objectives of the NSTIC Inspection Teams is to distribute copies of this

Manual and to conduct hands-on trainings on how to repair and maintain not only the NSTIC science equipment, but also the other defective science equipment like microscopes and balances.

It is hoped that this Manual which is subject to continuous improvement, would assist the teachers in repairing and maintaining lab materials to render them useful for many generations.

ARMISTICIA ACOSTA VAÑO
Executive Director

A C K N O W L E D G M E N T

The NSTIC Technical Group acknowledges the assistance of the following for the preparation of this Manual:

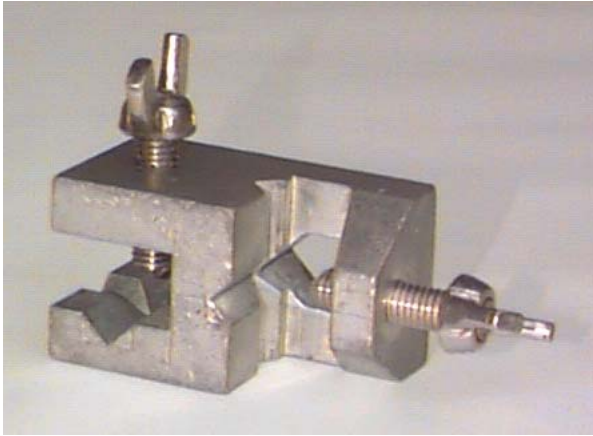
- ❖ Mr. Morita Akira of the Japan International Cooperation Agency-Japan Overseas Cooperation Volunteers (JICA-JOCV) for training the NSTIC staff in the repair and maintenance of microscopes and balances; and for sharing the valuable training materials of the aforementioned science equipment.
- ❖ The NSTIC Administrative Division Staff for their logistical support
- ❖ The Research and Development Division Staff for their untiring effort in writing and editing the entire manual.
- ❖ Dr. Armisticia A. Vaño for her valuable inputs in formulating the foreword and her support for the formulation of this manual.

NSTIC Technical Group

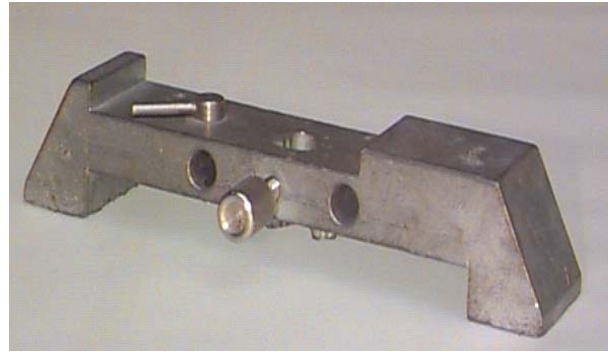
TABLE OF CONTENTS

TOPIC	PAGE
Batch-A: BASIC SCIENCE EQUIPMENT	1
Description	2
Maintenance	2
Tools and materials needed for repair	3
Repair	3
Batch-B: PHYSICS (MECHANICS) SCIENCE EQUIPMENT	4
Introduction for the repair and maintenance of batch-B	5
Tools and materials needed for repair of batch-B	5
Description of Storage Case 001	6
Maintenance	6
Repair	7
Description of Storage Case 002	8
Maintenance	8
Repair	8
Description of Storage Case 003	9
Maintenance	10
Repair	10
Description of Storage Case 004	11
MICROSCOPE	12
Description	13
Maintenance	14
Tools and materials needed for repair	16
Repair	17
BALANCES	28
Description	29
Maintenance	29
Tools and materials needed for repair	30
Repair	30

1



MULTICLAMP



STAND BASE



STAND SUPPORT



UNIVERSAL BOSSHEAD



UNIVERSAL CLAMP

Batch-A: BASIC SCIENCE EQUIPMENT

DESCRIPTION

Batch-A is described as Basic Science Equipment because the components are used mainly as mounting and clamping devices for various experiments in all Science subject levels. Most of the parts are made of metals; some are made of plastic. However, there is one component of batch-A that serves as one unit by itself, and this is the modular beam balance. Apart from this, all the other components must be assembled to form a solid framework for any experiment.

GENERAL GUIDELINES ON MAINTENANCE

1. Lubrication: wipe dry then lubricate the tips of rods and screws before storing them in the cabinet during vacation periods. This will prevent corrosion or oxidation thereby making the rods easy to insert into holes or the screws easy to adjust in place.
2. Storage: place the heavier items on the lower shelves of the storage cabinets
3. Oxides: polish oxidation spots on the surface of the equipment by using sandpaper #600.
4. Exposure to reagents: in cases wherein reagents with high level concentrations will spill into the equipment, wipe the affected area with a moist rag then disassemble the components and wash the affected area(s) with soap and flowing water.
5. Stress and strain on the equipment: batch-A items are strong and sturdy; however, they are not to be used for purposes other than those which they were meant to function. For example, do not use the rods as chinning or curtain bars; do not use the stand bases as table vises; do not use the rods as levers to move things or rollers to transport loads.
6. Impact forces: be careful not to drop the equipment; they may cause injury on your body due to the fact that they are made of metals.
7. Heating: be extra careful when working with heated substances. Since some equipment are used to support heated containers, they also conduct heat quite appreciably. Take extra precautions when you attempt to hold rods that could have possibly conducted heat. Some components of batch-A have rubber or plastic linings that have very low melting point. Keep them away from direct flame or surfaces that conduct high temperature

TOOLS AND MATERIALS NEEDED FOR REPAIR

Vise grip

Long nose pliers

Hammer

Center Punch

Reamer, 9.5mm

Table vise, 2" jaw

Sandpaper, #600

Lubricants like "Singer" oil or any unused light oil.

Rags

REPAIR

Problem 1: Wing nuts are loosened

Solution 1: Crimp wing nuts back in place

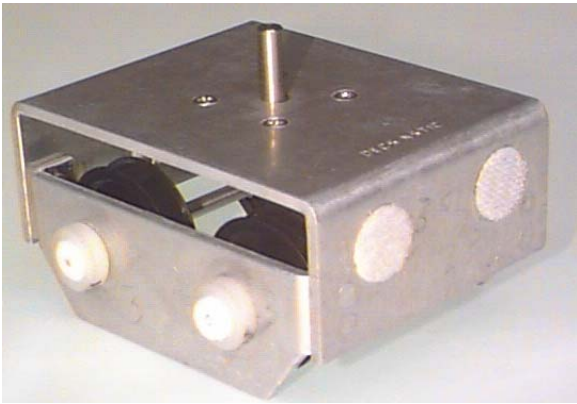


Wing nuts which are present in multiclamps and universal bossheads are sometimes loosened due to application of too much tightening force. To tighten back the wing nut in place, remove the wing bolt with the nut from the bosshead, clamp it into a table vise and slowly turn its lever to press the wing nut against the bolt and produce a locking effect.

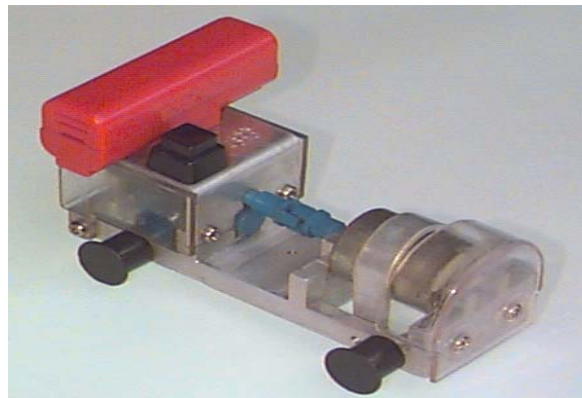
Problem 2: Rods are hard to insert into holes

Solution 2.1. Reboring of the hole

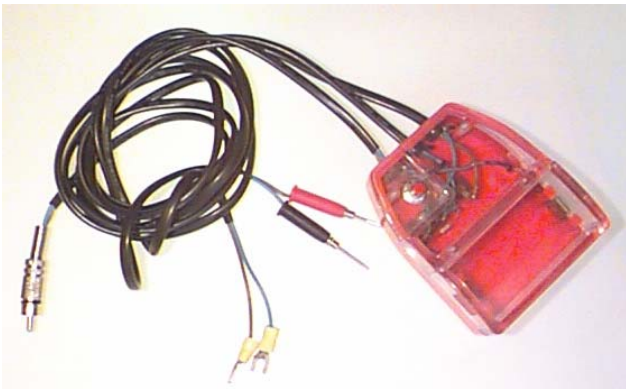
After a considerable period of time, some particles may settle on the linings of the holes in the stand bases or stand supports. The result is that it is very hard to insert the rods into these apertures. Just get a sandpaper and let it pass through these holes for cleaning. Or (if present), you can take a reamer, diameter=9.5mm and re bore the hole.



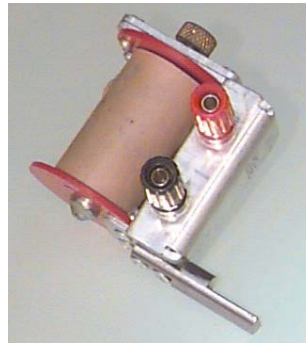
DYNAMIC CART



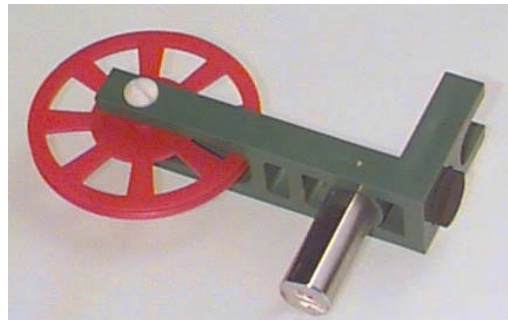
MOTORIZED CART



SYNCHROBOX



SOLENOID



STOPPER WHEEL

BATCH-B: PHYSICS MECHANICS

REPAIR AND MAINTENANCE OF BATCH-B SCIENCE EQUIPMENT

Batch-B is the term given to the package distributed by NSTIC that answers the equipment need for the topic on Mechanics; a big area of study in Physics and General Science.

The package was delivered inside storage cases, each of which contains several components. For convenience to the user of this manual, the sequencing of the repair and maintenance procedures will be presented on per storage case.

TOOLS AND MATERIALS NEEDED FOR REPAIR OF BATCH-B

Vise grip, 2"

Long nose pliers, heavy duty

Hammer

Center Punch

Reamer, 9.5mm

Table vise, 2" jaw

Lubricants like "Singer" oil or any unused light oil

Sandpaper, #600

Rags

STORAGE CASE 001

Storage Case 001 contain (aside from others) the major bulk of the Free-fall apparatus; these items need extra attention and they are:

- gate pad
- solenoid
- synchrobox
- digital timer

MAINTENANCE

DAILY	REGULAR
Gate pad must be properly stored in the storage case	Check the rubber padding
Solenoid must be properly stored in the storage case	Check the binding post and core
Synchrobox must be properly stored in the storage case	The dry cell must be removed from the case immediately after usage Check the condition of contact points like RCA jacks and terminal log Check the continuity of the connectors using VOM
Digital timer must be properly stored in the storage case	Refer to the user's manual of the timer

REPAIR

Problem 1: Loose contact between terminal points (RCA jacks; terminal logs)

Solution 1: Use fine sandpaper #600 (or contact cleaner) to enhance electrical contact; but if the connectors are totally destroyed, then replacement of the affected part is recommended. Or, replace batteries.

Confer with the T.H.E. teacher or any expert in electronics; otherwise, if all means have been exhausted, send the item(s) to NSTIC for major repairs.

STORAGE CASE 002

Storage case 002 contain the components for the experiments involving Dynamics set-up. Three items need careful consideration; these are:

- guide wheel
- cart B; spring-loaded cart
- cart A; dynamics cart with pole for the disc-shaped masses

MAINTENANCE

DAILY	REGULAR
Guide wheel must be properly stored in the storage case	Check wheel alignment <i>Avoid dropping the item as this might cause warping of the wheel or the axle may be dislodged from its position.</i>
Cart -B must be properly stored in the storage case	Check elasticity of the spring and spring functions Check wheel alignment
Cart-A must be properly stored in the storage case	Check wheel alignment

REPAIR

Since these items are made of non corrosive materials, they are expected to be durable and problems on their functionality are not so common. Just follow the daily and regular maintenance to maintain the life of the equipment.

STORAGE CASE 003

The biggest case in the batch-B package is the Storage Case 003. It contains mostly the components for Projectile set-up, Lever, Pulley, Friction, Hooke's Law and Uniform Motion. However, only some components need extra attention; these are:

- plastic tubings
- disc pointer
- rubber tubings
- motorized cart
- spring (Newton) balances
- nozzle holder
- extension springs (for Hooke's Law and Projectile Apparatus)

MAINTENANCE

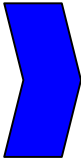
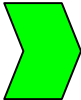
DAILY	REGULAR
Plastic hose	Must be cleaned by letting water go through the tube and wiped dry after use. Avoid bending the tube as this might cause a dent and thus affecting the passage of water
Disc pointer	Avoid dropping too often the pointer since this might result in the warping of the disc or breakage of the hook pointer
Rubber hose	After usage, the rubber tube must be cleaned by letting running water pass through the tube; then wiped dry. If the rubber tube is regularly allowed to dry in the open while still being wet, the rubber will eventually become brittle and will develop cracks on the surface.
Motorized cart	The dry cell must be removed from the case immediately after usage. Refrain from dropping the item since the plastic parts (battery case, switch and wheels) are breakable. Check continuity of the wires.
Newton balances	Refrain from stretching or loading the springs over their maximum capacities
Nozzle holder	Wipe the item immediately after usage to keep it dry. Do not remove the wing bolts from the item while being stored. This rule holds true for other items with loose parts attached to them.
Extension springs	Refrain from stretching or loading the springs over their maximum capacities

REPAIR

In order to avoid problems, proper maintenance must be strictly observed; otherwise if an item gets really destroyed, then the spare items must be used.

DESCRIPTION OF STORAGE CASE 004

Storage Case 004 contains the spare items that are used for the nine major set-ups in the batch-B package; namely:

1. FUNDAMENTAL QUANTITIES SYSTEM
 2. HOOKE'S LAW
 3. SIMPLE MACHINES
 - 3.1. Pulley
 - 3.2. Lever
 - 3.3. Inclined Plane
 4. MOTION SYSTEM
 5. FREE FALL APPARATUS
 6. PROJECTILE APPARATUS
-  **KINEMATICS**
-  **DYNAMICS**

It is of utmost importance that proper care be given to these spare items since they serve as replacements of the batch B components that are no longer functional. Daily and regular maintenance of these items must conform with the defined norms as stipulated in the preceding pages for Storage Cases 001, 002 and 003.