GENERAL NOTES FOR CLASSROOM TEACHERS

Using the Classroom Kits is relatively straightforward.

Each Classroom Kit is designed for two students.

Each kit requires the use of a pair of scissors to cut light cardboard triangles and a small amount of wood glue is a small open-necked container.

Wood Glue:

Wood Glue, available from Mechanical Kits Ltd., hardware stores and some convenience stores, is the best way of joining two pieces of wood. A triangle or gusset is used to secure the wood and it requires a small amount of glue applied using a stirring stick. There is no need to put any glue between the wooden pieces.

Work Area:

Students will need a clear area to work in such as a table top, a desk top or a bench. Paper towels are handy in case the wood glue spills. The container, such as a ketchup holder, should be half-full at the most.

Safety:

Safety is most important and students should know how to use scissors and how to carry them. There is no requirement for safety glasses normally, however check school policy to be sure.

Tolerance:

The wooden pieces in the kit are cut to within 1/16" of the required length. This is well within the ability of a gusset or triangle to hold the pieces together. A small gap between the pieces is permissible and does not affect the performance of the device.

The Kits:

There are six different kits: three kits that are designed to support the NFPA Fluid Power Project and three other kits designed for classroom or home-school use.

The Clamp Kit:

The easiest to construct is the clamp. It will pick up the object contained in the kit and demonstrates how a syringe can cause back and forth linear motion – reciprocating is the correct term. It would take a pair of students less than 1 hour to construct (approximately). Some fluidic applications, particularly the NFPA Challenge, require the students to design a way of picking up an object. This clamp is the easiest way to do it.

Using this kit the students understand a closed system where air is passed between the two syringes only and the concept of linear motion

The Lifter Kit:

This device works in the same way as an industrial lifter, for example a lifting platform. It takes 2 hours for a pair of students to construct (approximately). This is the model the students build at the Challenge Event Workshop. The Lifter is controlled by the action of a syringe or cylinder using air or pneumatic pressure applied by another syringe of equal volume.

The Rotational Arm Kit:

This kit demonstrates how a syringe can be used to cause rotary motion. It is the same principle as a robot arm turning or a back hoe rotating. It would take a pair of students 1 hour to construct or less. This kit demonstrates how to control a rotating base and/or arm. Most fluidic applications require a rotating movement and it is important to understand that both the arm and the mounting of the cylinder/syringe have to rotate to accommodate the syringe's linear motion.
In this way the linear in/out movement of the plunger may be effectively transferred into the rotational movement of the arm.

Pneumatic Arm Kit:

A 3-action pneumatic arm that combines the three basic functions: lift up and down; turn left and right, and clamping or grabbing. This kit requires no tools except scissors and some wood glue to construct as the pieces are pre-cut and drilled. Once tested and used pneumatically, water may be used in the cylinder-syringes and the arm becomes hydraulic. This is a fairly complex kit and requires at least 4 hours to construct.

Windmill Kit:

A hand-cranked Windmill kit that requires only scissors and wood glue, as the pieces are pre-cut. This kit is appropriate for grades 4 through 6 and demonstrates how pulleys can be combined to transformation movement. It is an effective illustration of the concept of ratio and therefore fractions. This kit takes at least 2 hours to construct.

Wheels & Axles Kit:

This Classroom kit builds one (1) vehicle. It requires only scissors and wood glue to construct as the pieces are pre-cut. It is appropriate for grades 1 through 3 and enables students to explore factors that influence force and movement including the size of wheels, mass of the vehicle and friction of the surface it runs on. Three (3) sizes of wheels are included. This kit takes about an hour to construct.

Where to start?

If you have no experience of using construction kits like these the Clamp Kit is the most straight forward and easiest to construct. The Lifter Kit, although more complex, is more dynamic.

Progression:

The NFPA kits demonstrate the three types of motion found in any robot arm: turning, up-down and grabbing. A progression might be to build all of the kits starting with the clamp, then the lifter and then the rotational arm and finally the Pneumatic Arm kit that incorporates the three actions.

Alternatively, builders could move on to designing their own robot arm and using tools to cut and drill wooden pieces.

A number of tool stations might be created for this type of activity, four or five if all the students what to use the tools at the same time. The Challenge Tool Box contains all the tools a station would need including a large mitre-box that is also a working surface to avoid damage to class furniture.

To be on our e-mail list: join@mechanical-kits.com

By joining our list we will be aware of other schools in your area who are using the kits and, if there is a sufficient number, invite the NFPA. to hold a Challenge in your area. For more information on this event: http://www.nfpafoundation.org/FPChallenge/Index.aspx

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