Stability Recommendations

When utitlizing the Stability Solution, it is recommended that adjustments be made on the motor prior to active use of the device. The motor included in the solution has adjustable limits which alter the actuation range, which may be changed to better suit the desired conditions set by the user.

It is advised that all clamps be tightly fastened on the steering assembly before utlizing the stability solution. Similarly, the Stopper Actuator should be securely adhered to the forklift floor before use.

Switch:

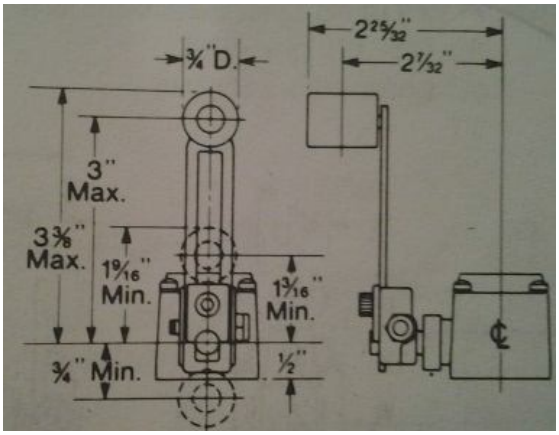
The team used a magnetic door switch on the initial prototype to demonstrate how it would work but this switch is not the one intended to be used if the design were to be manufactured. The magnetic door switch presented in **Element G: Construction of a testable prototype** was the one the team used in the demo prototype. The switch presented is the element is the switch actually chosen for the design.

Limit switch: 802T-NPTP NEMA type 13 oiltight 2-circuit.

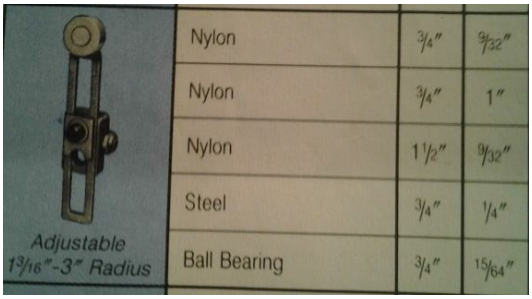
Lever: Roller lever 802T-W2B

Both the limit switch and the lever are from the Allen Bradley Brand.

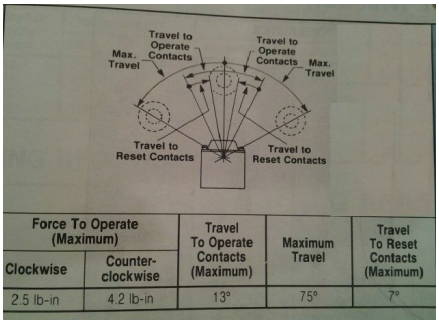
"Roller lever attachment" Picture Source: taken by *[redacted student name]* on 05/02/2013



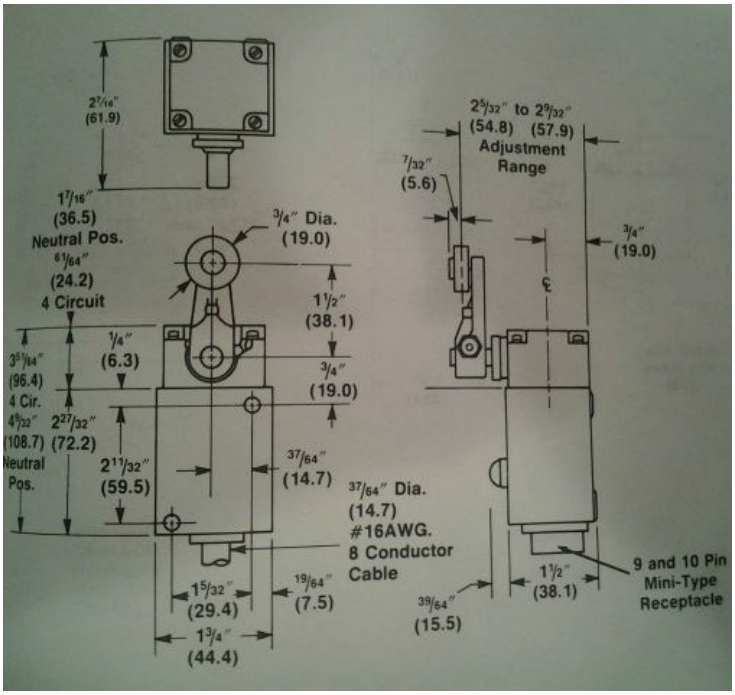
"Roller lever drawing" Picture Source: taken by *[redacted student name]* on 05/02/3013



"Roller level material"Picture Source: taken by *[redacted student name]* on 05/02/3013 **Note that the steel would have been the one used.

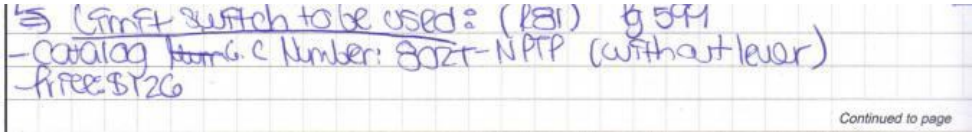


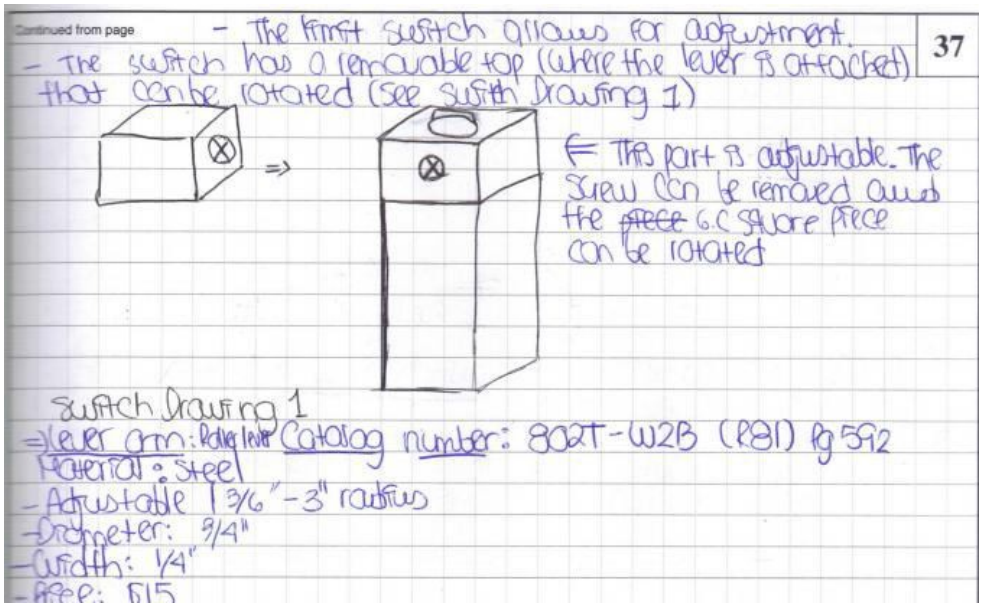
"Roller lever angle capaxity" Picture Source: taken by *[redacted student name]* on 05/02/3013



"Limit switch body drawing" Picture Source : taken by *[redacted student name]* on 05/02/2013

One of the reasons as to why this limit switch and roller lever where chosen was that these allow for adjustments, making both of these capable of functioning on various styles of forklifts.


5 Limit switch to be used: (RBI) pg 577
-Catalog ~~Item~~ G.C Number: 802T-NPTP (without lever)
-Price $126
Continued to page


Continued from page
- The limit switch allows for adjustment. 37
- The switch has a removable top (where the lever is attached) that can be rotated (see switch drawing 1)

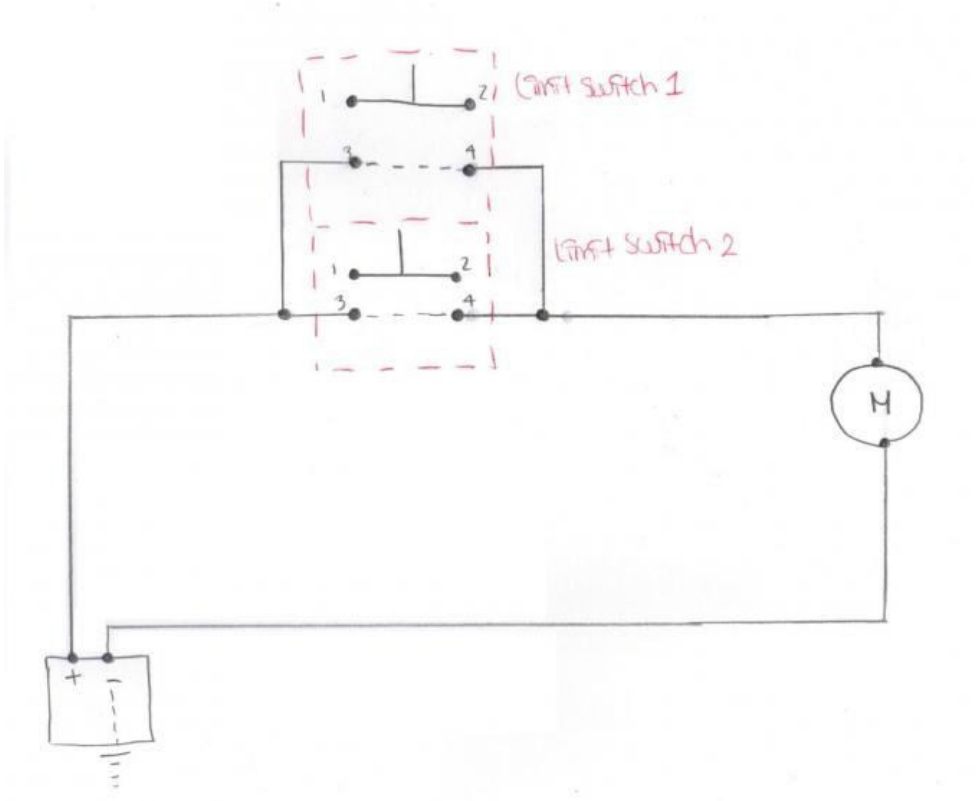
⇐ This part is adjustable. The screw can be removed and the ~~piece~~ G.C shore piece can be rotated
Switch Drawing 1
=lever arm: Roller lever Catalog number: 802T-W2B (RBI) pg 592
Material: steel
-Adjustable 1 3/16" - 3" radius
-Diameter: 3/4"
-Width: 1/4"
-Price: 515

(Pictures above are excerpts from the 04/23/13 entry of *[redacted student name]* Engineering Notebook.)

Limit switches were not included in the prototype due to the lack of budget. Also magnetic door switches are not designed to handle the warehouse environment that forklifts are surrounded by meanwhile limit switches are rated for industrial use. Another reason why the magnetic door switch would not be used is due to the initial location intended for this switch (see **Element F**). Drilling on five inches of solid steel is not feasible and attaching the door switch by adhesive means is not durable.

-The main differences between the ways the magnetic door switch and the limit switches are going to be wired is that the magnetic door switch is being used as a normally closed switch; when the is a brake in the circuit, meaning the connection is opened, a signal is sent to the motor and it activates. In this case there is only need for one switch. With using the limit switches two are needed, one for each corresponding wheel. Unlike the magnetic door switch, these switches are normally open not normally closed.

-The limit switches would need to be wired parallel, as the simple schematic below shows. There needs to be one switch on each wheel with the roller lever arm located facing the same direction. When the wheels turn the inside of the wheel makes contact with the roller lever arm closing the circuit. The turning angle of the lever allows for the wheel to turn completely without interference of the switch or the lever. Placing the other limit switch above the other wheel in the same direction as the first one allows the system to account for both directions.

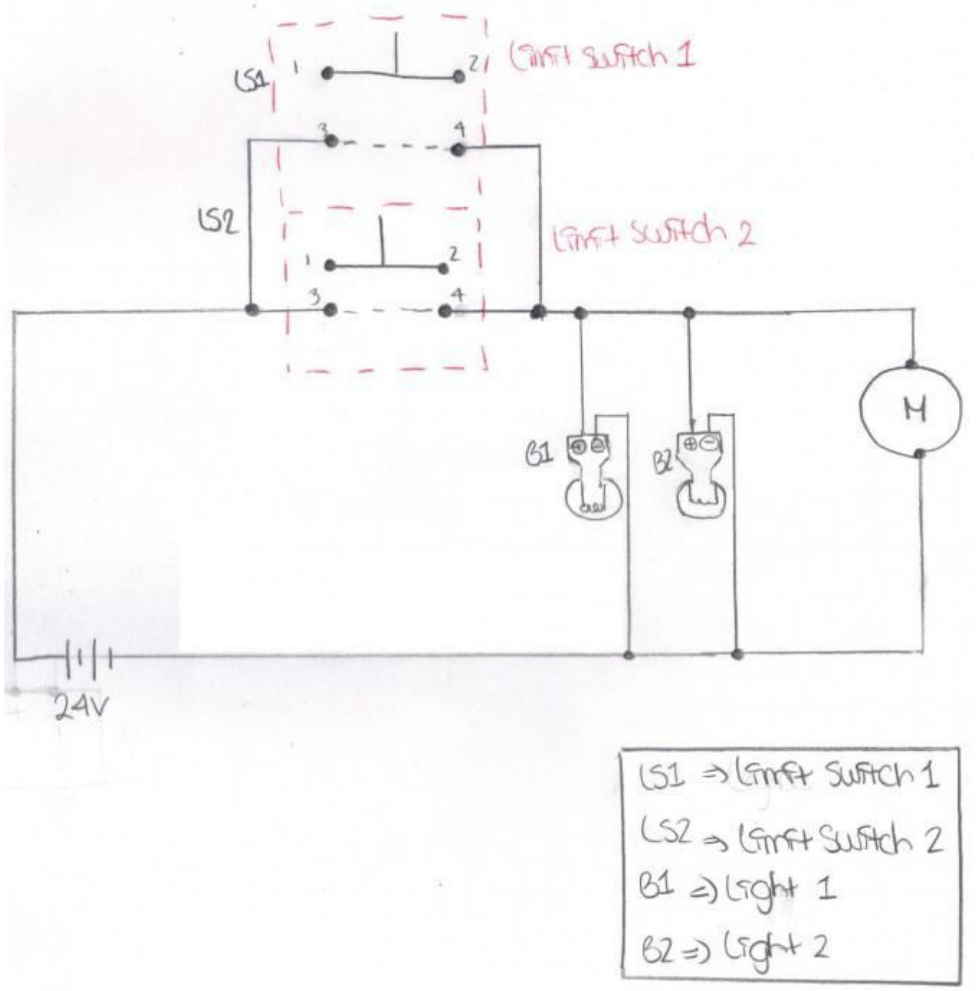


(Picture of above schematic was copied from the 05/02/13 entry of *[redacted student name]* Engineering Notebook.)

Warning System:

- The “Speed Regulator Failure Analysis,” located in element F, showed that a warning system was needed in order to alert the operator that the system had been actuated. From the “The Speed Regulator Alert System” matrix it was found that the dual lights would be the most effective. As of now the lights have not been included in the system.

-It is recommended for the to be included in the circuit as shown in the following schematic:



(Picture of above schematic was copied from the 05/02/13 entry of *[redacted student name]* Engineering Notebook.)

It is recommended for the lights to be located on each side of the overhead guard as shown in the image below.

Picture Source: Taken by *[redacted student name]* on 11/17/2012. Last edited to show “lights” on 04/1513

Visibility

Recommendations

Two failure analyses written and researched on the current iteration of the visibility design indicate that the portion of the device that the operator looks at presents a safety hazard. The safety concerns involve a situation where the device locking system fails and the device swings downward into the operator's head, or the forklift stops suddenly and the operator's head collides with the device. Because safety is one of the most important product specifications, the visibility team suggests that this problem be solved in one or two of the following ways:

- The part of the device that the operator looks at is covered with foam or other absorbant material to cushion any impact that the operator's head might make with the device.

- The device include some type of safety function that slows down the decent of the device from the "in use" to the "not in use" position. One such idea to accomplish this was the incorporation of pneumatic struts.

The visibility team strongly recommends that an alternative method of attaching the device to the overhead guard be developed. The current iteration of the visibility device prototype calls for a part to be welded onto the front bar of a forklifts overhead guard. However, because welding anything onto the forklift overhead guard is against OSHA regulations, this one component of the design weakens the viability of the device.

The team suggests that either lighter weight materials be explored for the device box and mirror section parts, or an easier way of transporting the device be developed. The current built prototype is constructed out of 1/8in steel, which is strong enough for the rough working conditions that the device has to withstand. However, the weight of the device and the orientation of the parts makes it possible for one person to carry, but far preferable for two people to carry. Not only must the device be carried, but it also must be mounted to the forklift overhead guard. The weight of the device makes it awkward and difficult to attach and definitively

requires two people.

One such way to make the visibility device easier to transport could include one of the two methods devoloped by the visibility team:

- Wheels are added to one of the sides so that the device could be handled in a similar way as a hand truck.

Handles could be welded onto the device front so that the device could be carried much